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AUTOMOTIVE INDUSTRIES

Founded 1895

Vol. 76, No. 1

January 2, 1937

This Week

Joseph Geschelin starts off the New Year with a description of what he says is one of the most self-contained and self-reliant plants in the industry. Turn to page 8.

A new "baby" car that Adam Opel has just introduced to the European market has some interesting features that are described on page 22.

Details of the Ford power plant are shown on page 25 while pages 23 and 24 have some more mechanical details of the 1937 passenger cars.

"Five Million Cars in '37"

Huge Bank of Unfilled Orders Gives Expectation Year's Production Will Approach That of 1929

By Harold E. Gronseth

The start of the new year finds the automobile industry operating full tilt with its leaders confidently looking forward to a 5,000,000-unit output in 1937. That appears to be the minimum expectation for the post-depression peak that is due to be reached this year and will compare with the all-time record that was set in 1929 when 5,621,715 cars and trucks were produced.

The industry carried over into the new year the largest volume of unfilled orders ever held at this time, estimated in excess of 250,000. Despite the heavy production in recent weeks, some of the leading companies still had enough advance business booked to keep their plants busy from three to six weeks. Even with uninterrupted operations, little will be accomplished toward stocking dealers until February. Normally dealer inventories should be at a maximum about March 1, since after that date retail sales through the spring months absorb about all the vehicles the plants can turn out.

Barring shortages in parts or materials, motor vehicle production will be held just about at top level throughout the first half of 1937. In order to attain the goal of 5,000,000 units for the year, production must average better than 416,000 units a month and 1,250,000 units a quarter. Only the second quarter of 1936 exceeded that total.

Approximately 56.5 per cent of the 1936 motor vehicle production was accounted for in the first six months of the year. The same ratio applied to the anticipated 5,000,000 units this year would mean an output of 2,825,000 units in the first half of 1937. The first quarter of 1936 accounted for roughly 24 per cent and the second quarter 32 per cent of the year's total. If the same ratios hold in 1937 and the 5,000,000-unit goal is attained then we may look for upwards of 1,200,000 units in the first quarter and 1,600,000 in the second quarter. In other words, the first three months of 1937 should average better than 400,000 vehicles a month and the second quarter will have to average more than 500,000 vehicles monthly.

Preliminary estimates indicate that December output ran somewhat better than 480,000 cars and trucks or well in excess of the 418,317 units turned out in December, 1935, despite the troubled labor situation which hampered operations. Final figures on November production, published by the U. S. Department of Commerce, showed a total of 405,702 units, or 2848 units under the figure for November, 1935. This brought the 11 months' total to 4,097,725 units and indicates a total output for 1936 of 4,577,000 cars and trucks.

(Turn to page 7, please)

SAE Annual Meeting

Program Covers Wide Automotive Interests; Eckener to Speak

The annual meeting of the Society of Automotive Engineers will open Jan. 11 at the Book-Cadillac Hotel in Detroit and will close Jan. 15. Dr. Hugo Eckener will be the principal speaker at the annual meeting dinner the evening of Jan. 14, which will be presided over by V. P. Rumely, chairman of the Detroit Section, with W. J. Davidson as toastmaster. Dr. Eckener's subject will be "The Airship and Its Place in Modern Transportation." Other speakers will be R. R. Teetor, SAE president, and H. T. Woolson, SAE president-elect. Presentation of the Bendix trophies will also be made during the dinner.

The complete revised program follows:

Monday, Jan. 11

10:00 a.m. *Transportation and Maintenance*

H. W. DRAKE, Chairman

Vehicle Design from a Maintenance and Operating Standpoint—F. L. FAULKNER, Armour and Company, and collaborators.

10:00 a.m. *Fuels and Lubricants*

T. B. RENDEL, Chairman

A Sparking Plug, Adapted for Measuring Cylinder Head Temperatures—G. D. BOERLAGE and A. G. CATTANEO, Royal Dutch Shell Engine Research Station, Delft, Holland. To be presented by A. G. MARSHALL, Shell Oil Co.

(Turn to page 6, please)

Thomas with Chrysler

Educator Leaves Clarkson to Head Institute of Engineering

Dr. James Shelby Thomas, author, educator and economist, who has been president of the Clarkson College of Technology since June, 1933, has been appointed head of the Chrysler Institute of Engineering, it was announced this week by Fred M. Zeder, vice-chairman of the board of the Chrysler Corp.

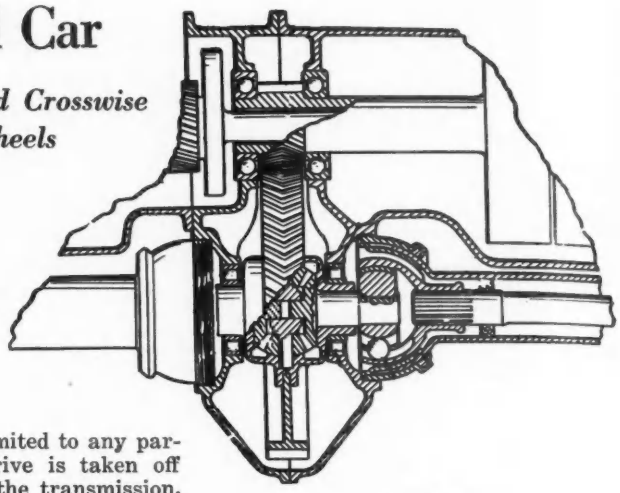
Dr. Thomas is a graduate of Milligan College. He continued his studies at the University of Chicago and abroad, later taught at Milligan and Lynchburg Colleges, became dean of the faculty at Lynchburg and served as dean at the University of Alabama where he organized and directed the first extension division in any southern university. He also served as chief economist of the Commonwealth and Southern Corp. and was associate director of the Alabama State Industrial Board.

In directing the Chrysler Institute, Dr. Thomas will be assisted by Professors J. J. Caton and H. C. Anderson. It is planned to improve and expand the scope of the school under the new management. Established originally to fit graduate engineers for masters' degrees, the institute now includes undergraduate students who are also employes of the Chrysler Corp. and has nearly 1000 active students.

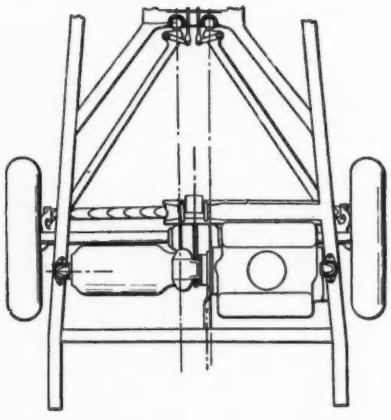
Ford Patents Rear-Engined Car

Powerplant-Differential-Drive-Gear Unit Is Mounted Crosswise Back of Axle with Drive Through Rear Wheels

Another patent on a rear-engined automobile has been issued to Henry Ford (U. S. Patent No. 2,065,065, automobile chassis construction, Dec. 22). In the new design, on which an application was filed May 10, 1935, the drive is through the rear wheels and the powerplant is mounted crosswise directly back of the axle. The differential and drive-gear housing forms a unit with the powerplant, and the rear-axle halves are arranged so they can oscillate in the vertical plane. Radius rods extending forward and inward are formed integral with the axle tubes. These radius rods are supported by ball joints from a frame member at their forward end, in longitudinal alignment with spherical joints at the inner end of the axle tube. The entire powerplant, including the driving gear, is resiliently mounted on the chassis frame and through it is supported on the chassis spring. The mounting is said to be such that vibrating forces originating in the engine tend to cause



Details of final drive of Ford-patented rear-engined car



Plan view of Ford-patented rear-engined chassis

the whole powerplant to oscillate around the drive-gear axis.

Another advantage claimed is an improved weight distribution, as location of the powerplant back of the axle lowers the rate of oscillation of the chassis around its center of gravity; besides, it moves the center of gravity toward the rear, bringing it close to the center of the passenger space, which reduces the effects of vertical oscillations on the passengers.

Rear suspension of the chassis is by a single transverse spring located ahead of the axle. Two frame cross members at the rear form a rectangular compartment into which the power unit is set. The engine shown in the drawings is the familiar Ford V-8; its crankshaft is splined to a drive shaft which extends through to the outer end of the transmission housing. While a planetary transmission is indicated, the invention is not limited to any particular type. The drive is taken off at the engine end of the transmission, by means of a herringbone pinion on a tubular shaft, this pinion meshing with a herringbone gear on the differential. The outer ends of the engine and transmission are flexibly supported on the frame side members by brackets resting on rubber biscuits, and the forward side of the differential or drive-gear housing is supported by a bracket which is anchored in rubber at the center of a frame cross member.

The granting of this patent is a routine procedure, according to Mr. Ford, and does not mean that the company is contemplating any immediate change in the design of its cars. "It is one of the many engineering developments of our research and we are merely protecting our invention," said Mr. Ford.

New York Show Advanced To October 27 This Year

The National Automobile Show will open two weeks earlier this year on Oct. 27 and will close Nov. 3, it has been announced by the Automobile Manufacturers Association.

The earlier date is expected to make more efficient the distribution of the special chassis and demonstration units, Alfred Reeves AMA vice-president, stated,

The show committee in charge of this year's affair includes Alfred H. Swayne (General Motors), chairman, Byron C. Foy (Chrysler), and Paul G. Hoffman (Studebaker), with Alfred Reeves, manager.

Union Attack on GM Spreads

Four Fisher Body Plants Now Closed as Union Leaders Refuse Local Settlements and Demand Nation-Wide Agreement

Plant No. 2 of Fisher Body in Flint closed Wednesday morning, Dec. 30, after a score of men sat down protesting demotion of two inspectors for wearing union buttons. Between 500 and 600 men out of a total of 1200 on the shift are still in the plant, which makes bodies for Chevrolet. This is the fourth Fisher Body plant on strike, other points being Atlanta, Kansas City and Cleveland.

Immediately on receipt of news that the Fisher Body plant in Cleveland was on strike, officers of the United Automobile Workers met Monday and called a conference of representatives of General Motors' unions to be held in Flint on Sunday, Jan. 3. The purpose of the Flint conference will be to get the approval of GM union representatives of an agreement being prepared by international officers as a basis for collective bargaining with the corporation, according to a statement issued by Windham Mortimer, vice-president of the UAW.

That Cleveland will be made the spearhead in the union move for a showdown with General Motors was indicated by the arrival there of Mortimer from Detroit Dec. 30 and his immediate taking charge of the strike activities which began Monday. Mortimer turned down a peace proposal submitted to both the union and the local management of Fisher Body by Harold H. Burton, mayor of Cleveland. The management had accepted the plan, under which work would resume simultaneously with the opening of negotiations on local issues.

No move towards peace in the flat glass industry has yet been made by either union or companies since the sitdown at Libbey-Owens-Ford plants started Dec. 15. There is an attitude of growing discontent with the situation on the part of many of the idle workers. Some days, fewer than 100 workmen have reported at the three Toledo plants to sitdown. Union meetings have been held this week in Toledo and Ottawa, Ill., but in the absence of Glen L. McCabe, national president, who was in the Pittsburgh region, no specific action was taken.

Libbey-Owens-Ford has pulled fires in three of the 12 furnaces at Charles-

ton, W. Va., and two of the three furnaces at Shreveport, La. Fires are being kept up in the plate glass plant in Toledo for a few days in hopes of some move toward a settlement.

Plant No. 3, Bohn Aluminum and Brass Corp., in Detroit, was stopped Monday by a spontaneous sitdown strike protesting the layoff of a union man. Strikers have drafted a peace proposal demanding increased wages, a minimum of 65 cents an hour for women and 75 cents for men. Less than 100 strikers occupy the plant which the management said will be closed for inventory until after the first of the year.

Starting with a partial force Dec. 26, full production was resumed Monday at the Kelsey Hayes Wheel Co. plants in Detroit after a 10-day strike.

Nash Pays $85,000 Bonus

Approximately $85,000 in cash was distributed by the Nash Motors Co. in Christmas gifts to its employes. Every worker in the shops and offices of the company's three plants, located at Kenosha, Racine and Milwaukee, regardless of length of service, was included in the disbursement.

Don Blanchard

Program of the Coming Congress

Much Legislation for Further Regulation of Business on Calendar, Some with Administration Support

By L. W. Moffett

The Seventy-fifth Congress will convene next Tuesday, Jan. 5, organize, and on the day following will have a legislative program laid before it by President Roosevelt. So overwhelmingly New Deal will be the Congress that, despite sharp differences that will inevitably develop among groups, it is the belief of political observers that recommendations of the President will prevail with slight, if any, modifications.

Administration legislation concerning industry probably will not affect the automotive industries any more than it will affect industry generally. Largely it is expected to relate to labor with a view to maintaining or improving wage and hour standards, and will have the endorsement of organized labor, which, through the Committee on Industrial Organization, campaigned vigorously for the reelection of the President.

No new "NRA," as such, is expected to be asked. But as a matter of supporting wage and hour standards, it is reported that the President may suggest modified forms of NRA over and above a new coal bill, which he undoubtedly will urge.

The Richberg-Berry plan may also find favor either as it has been proposed or in redrafted form. It would provide for voluntary trade agreements, and thus not be amenable to constitutional attack, together with wage and hour standards. A separate government agency would pass tentatively upon the agreements. If they were considered "in the public" interest they would be exempt from the anti-trust laws. If later found to be objectionable a cease and desist order would be forthcoming from some other government agency, perhaps the Federal Trade Commission. The offending trade practices would be abandoned without subjecting the affected industries to the anti-trust laws or prosecution of any kind.

The administration has not indicated approval or disapproval of the bill of Senator O'Mahoney requiring federal licenses for corporations. It also carries wage and hour standards. No corporation would be granted a license unless it agreed to such standards. As a matter of escaping attack on constitutional grounds O'Mahoney is revising the bill so as to provide for interstate compacts. Goods shipped in interstate commerce would have to be produced under the standards provided in the measure. They would cover minimum wages and maximum hours and also would abolish child labor.

It is said also that the administration is encouraging the idea of state compacts with relation to fair trade practices. This again would be a means of setting up an NRA, state by state, and at the same time insulate it against court attack on the grounds of being unconstitutional. The compacts obviously would carry wage and hour standards.

It is doubted that the Patman-Robinson anti-price discrimination act will be modified at the forthcoming session of Congress. Rather such modifiaction is expected to await test cases. Representative Patman of Texas, one of the authors of the act, will, however, introduce legislation to segregate production and distribution. Though legal opinion strongly holds such a law is unconstitutional, that will not prevent efforts being made to enact it, although they will probably not be successful. Patman also is urging a model anti-price discrimination act for the states as an alternative for the Patman-Robinson act in the event the latter is wiped off the statutes by the Supreme Court.

Obviously if the Wagner labor act is held unconstitutional, some substitute for it will be offered in Congress unless various separate pieces of legislation covering wages and hours have been enacted in the meantime and serve the purpose of the act.

Don Blanchard to SAE

Former Chilton Editor Named Secretary of Engineering Relations

Donald Blanchard, formerly editor of AUTOMOTIVE INDUSTRIES and later of *Automobile Trade Journal*, has joined the Society of Automotive Engineers headquarters staff as secretary of the engineering relations committee, John A. C. Warner, secretary and general manager of the society, announced Jan. 1.

The committee is charged with supervision of all contacts between the SAE and outside agencies and has found the demand for its services constantly increasing since its formation more than a year ago. Particularly great has become the need for a more thorough and continuous contact between automotive engineers and technicians of administrative and regulatory agencies in order to remove technical safety matters from the argumentative field by providing an uninterrupted supply of engineering facts.

After graduating from Columbia University in 1915 with the degree of electrical engineer, Mr. Blanchard served as an officer in the U. S. Navy and worked for some time in the machinery field. In the 17 years since he first joined the Chilton Co., Mr. Blanchard has made his influence felt in every part of the automotive field. As editor of *Commercial Car Journal* he became familiar with transportation and maintenance problems. He was later editor of AUTOMOTIVE INDUSTRIES and handled problems of design and production from the standpoint of the manufacturer. Finally, as editor of *Automobile Trade Journal*, the position from which he has just resigned, he has been of great assistance to automobile dealers with their merchandising and legislative problems.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for AUTOMOTIVE INDUSTRIES

Business activity continued at a comparatively high rate last week, notwithstanding the approach of the year-end holiday and inventory period and the increasing signs of possible labor disturbances in some lines. Indications continue to point to an exceptionally large volume of holiday business at retail. A feature of the business situation last week was a further sharp advance in prices on several of the principal commodity exchanges, including wheat, cotton, copper, and rubber.

Business Level Highest Since 1930

The index of business activity of the Guaranty Trust Co. for November stands at a preliminary figure of 92.9, the highest since June, 1930, as against 91.0 for October and 80.3 for November, 1935. The company's wholesale price index for Dec. 15 is also the highest since June, 1930, standing at 65.1, as compared with 62.1 a month earlier and 52.5 a year ago.

Electric Output Gains

Production of electricity by the electric light and power industry of the United States for the week ended Dec. 19 was 13.6 per cent larger than in the corresponding period last year. The gain above last year's comparable figure was 14.9 per cent in the preceding week, 13.9 per cent two weeks earlier, and 13.7 per cent three weeks earlier.

Farmer's Income 12 Per Cent Higher

Gross income from agricultural production for 1936 will be approximately 12 per cent larger than the 1935 total, according to an estimate by the Department of Agriculture. Income available for the farmer's labor, capital, and management, arrived at by deducting expenditures for materials, wages, interest, taxes, rent, and depreciation, is estimated to be 17 per cent above the 1935 figure and only seven per cent below that for 1929.

Life Insurance Sales Lower

Sales of ordinary life insurance in the United States in November were three per cent smaller than those a year ago. Sales during the 12 months ended Nov. 30 were four per cent below those in the corresponding period a year earlier.

Crude Output at New High

For the second successive week, crude oil production established a new high record during the week ended Dec. 19. Average daily output for that period amounted to 3,145,700 bbl., as against 3,119,500 bbl. in the preceding week and 2,850,050 bbl. in the corresponding period last year. The allowable figure under the restrictions imposed by the various oil-producing states for December, according to the calculations of the Department of the Interior, was 2,930,300 bbl.

Fisher's Index

Professor Fisher's index of wholesale commodity prices for the week ended Dec. 26 stands at 87.9 a new high for the year, as against 87.3 the week before, 86.6 two weeks before, 86.7 three weeks before, and 86 four weeks before.

Federal Reserve Statement

The amount of Federal Reserve bank credit outstanding increased $59,000,000 during the week ended Dec. 23. The monetary gold stock rose $7,000,000 and the amount of money in circulation $128,000,000, while member bank reserve balances declined $167,000,000. The latter were estimated to be approximately $1,880,000,000 in excess of legal requirements.

Stewart's "A" Line

New Truck Models Range from 2 to 4-Ton Capacity

In its new "A" series of trucks just announced the Stewart Motor Corp. has combined beauty of line with utility. The models in the series are the 45A, 1½ to 2-ton capacity; 50A, 2½ to 3½-ton capacity; 47A, 2 to 3-ton capacity, and the 49A, 3 to 4-ton capacity. Two models are equipped with two-speed rear axles and they are known as the 45AS and the 50AS.

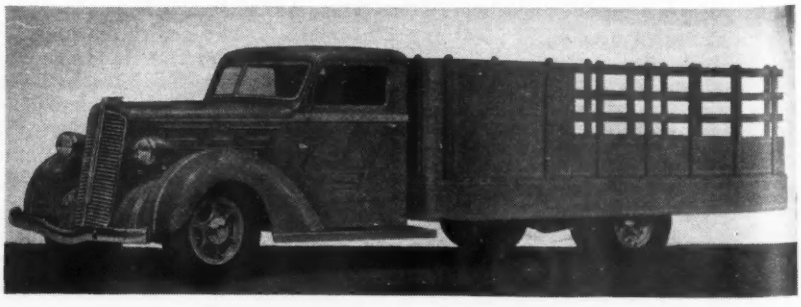
The 45A is powered with a 3⅜-in. by 4⅛-in. Waukesha engine having 222 cu. in. displacement. This engine develops 155 lb. ft. of torque and 65 hp. at 2800 r.p.m. The 50A has a 3⅜-in. by 4¼-in. Waukesha engine of 263 cu. in. of piston displacement. The torque is 175 lb. ft. and the horsepower is 77 at 2800 r.p.m.

The 47A incorporates a 3½-in. by 4¼-in. engine of the same make having 165 lb. ft. of torque and 70 hp. at 2800 r.p.m., while the 49A has a 3¾-in. by 4¼-in. engine of 282 cu. in. piston displacement giving 190 lb. ft. of torque and 83 hp. at 2800 r.p.m.

Size 6.00/20 tires with duals rear are standard on the 45A, and the 47A and 50A use 6.50/20 tires. The 49A has 7.00/20 tires. All have duals in the rear and all have hydraulic brakes.

Good visibility is an added feature. Broad V-type windshields, narrow pillar posts and large door glasses give the driver a clear view. The cab, which is of the coupe type, provides ample room for three men to ride in comfort. New fender lines and radiator grille add to the appearance and the fenders are so curved that there is easy access to all engine parts. Front axles have been relocated for better load distribution, which with the perfected geometry of the whole steering mechanism makes for easier handling in city traffic.

There has been no sacrifice of accessibility or of practical advantages for the sake of extreme styling or good looks. Indicating instruments have been grouped in a convenient location. Special adjustable ventilators in cowl and doors keep the cab provided with a constant flow of fresh air. Small drivers' conveniences such as glove compartments and cigar lighters are in evidence.



Stewart Model 45-A truck, 1½ to 2-ton capacity

40 Years Ago

—with the ancestors of AUTOMOTIVE INDUSTRIES

Foreign Notes

Motor carriages are now allowed in the Bois de Boulogne, a privilege which has hitherto been denied by the authorities.

A commission is now engaged in drawing up a set of regulations to govern motor vehicle traffic in France. Among its members are such well-known men as Levassor, de Dion, Bollée, Jeantaud and Scotte. A liberal code may, therefore, be looked for.

The electric omnibus of Radcliffe Ward was recently given a very satisfactory test in London. It carried 25 passengers from the Hotel Victoria through Trafalgar Square to the Marble Arch in 13 minutes, beating cabs and hansoms en route.

—From *The Horseless Age*, January, 1897.

Lower Priced Whites

Model 700, Capacity 1½ Tons, Lists at $985 Up

The lowest-priced White truck ever to be placed on the market will be listed at $985 and up, rated in the 1-1½-ton field, and will be turned out in two models—Model 700 and 700K tractor. Embodying well-balanced mechanical specifications, the new series will make available a group of optional features such as wheelbases, transmissions, rear axle ratios and tire sizes, to meet the requirements of specific operations.

The outstanding single feature of the new 700 series will be a new White six-cylinder engine of 250 cu. in. displacement, having light-weight deluxe pistons and an exclusive water cooling system for the valve seats.

The latter system provides a constant flow of cooling water against that portion of the cylinder block surrounding the exhaust valve seats, thus eliminating the threat of block warpage and valve pitting, while insuring long life at this point. The new motor is equipped with a heavy seven-bearing counterweighted crankshaft mounted with a vibration dampener which, along with an improved four-point rubber engine mounting, makes possible the smooth, vibrationless action so essential to present day engine operation. In the new engine, excessive wear on piston pins and bushings is prevented by rifle-drilled connecting rods which allow full-pressure lubrication to these vital points.

The engine is equipped with a vacuum-controlled distributor which permits

(*Turn to page 28, please*)

Chevrolet '37 Trucks

Commercial Models Have Larger, More Powerful Engines

The Chevrolet line of 1937 commercial cars and trucks, completely redesigned in chassis and bodies, has been announced. All models have a new six-cylinder, valve-in-head, high compression engine of increased horsepower, placed farther forward in the chassis to make room for larger bodies on the commercial cars and improved load distribution on the 1½-ton models.

The new engine develops 78 hp. at 3200 r.p.m., an increase of 6 hp. over the previous model. Torque is increased from 155 lb. ft. to 170 and is maintained at its maximum over a wider range of engine speeds, from 850 to 1550 r.p.m., corresponding to road speeds of 2 m.p.h. in low gear to 27 m.p.h. in high with the Chevrolet four-speed transmission.

These operating advantages have been made possible through extensive redesign and improvement of the power plant. Piston displacement is increased to 216.5 cu. in. and the compression ratio raised to 6.25. Although larger, the new pistons are both lighter

(*Turn to page 30, please*)

Preliminary Facts and Figures of the Automobile Industry

During 1936

From the Automobile Manufacturers Association

Production and Value	
Car and truck factory sales, U. S. and Canada	4,565,000
Passenger cars	3,767,000
Motor trucks	798,000
Percentage increase over 1935	11%
Wholesale value of cars, U. S. and Canada	$1,991,300,000
Wholesale value of trucks, U. S. and Canada	$ 457,625,000
Wholesale value of cars and trucks combined	$2,448,925,000
Wholesale value of parts and accessories for replacements and service equipment	$874,687,000
Wholesale value of rubber tires for replacement	$303,000,000
Motor vehicles, accessories, service equipment and replacements of parts and tires	$3,626,612,000
Registration	
Motor vehicles registered in U. S.	28,270,000
Motor cars	24,250,000
Motor trucks	4,020,000
World registration of motor vehicles	40,000,000
Per cent of world's automobiles in U. S.	71%
Taxes	
Total motor vehicle user taxes	$1,400,000,000
Gasoline taxes, federal, state and municipal	880,000,000
Percentage motor user taxes to all taxes from all sources, federal, state and local	14%
Automobile's Relation to Other Business	
Automotive industry is the largest purchaser of gasoline, rubber, steel, malleable iron, mohair, lubricating oil, plate glass, nickel and lead.	
Number of carloads of automotive freight shipped over railroads	3,525,000
Rubber used by automobile industry	75%
Plate glass used by automobile industry	72%
Steel used by automobile industry	22%
Lumber, hardwood, used by automobile industry	7%
Copper used by automobile industry	17%
Lead used by automobile industry	35%
Zinc used by automobile industry	15%
Tin used by automobile industry	13%
Aluminum used by automobile industry	16%
Nickel used by automobile industry	28%
Gasoline consumption by motor industry	89%
Gasoline used by motor vehicles (gallons)	17,900,000,000
Gasoline consumption by motor vehicles, retail value including taxes	$3,300,000,000
Lubricants used by motor vehicles (gallons)	535,000,000
Lubricants, per cent used by motor vehicles	57%
Number of tires shipped	53,000,000
Crude rubber used by motor industry (pounds)	960,000,000
Cotton fabric used in tires (pounds)	226,000,000
Motor Trucks and Buses	
Motor trucks in use	4,020,000
Total special motor truck taxes	$354,000,000
Trucks represent 14% of all motor vehicles, and pay 25% of all motor taxes.	
Fleets of more than 5 trucks, no. of operators	29,500
Number of truck drivers	3,000,000
Communities served exclusively by trucks	48,500
Motor buses owned	120,000
Number of buses in revenue service	47,500
Number of buses in local or transit service	20,000
Consolidated schools using motor transportation	23,650
Buses used by consolidated schools	74,000
Buses used by street railways	12,000
Street railways using motor buses	190
Companies in city service including street railways	800
Steam railroads using motor buses	65
Foreign Sales	
Number of American motor vehicles sold outside U. S. (U. S. exports and output in Canadian plants owned by U. S. firms)	501,000
Per cent of production sold outside U. S.	11%
Value of motor vehicles, parts and tires exported from U. S. and Canada	$265,000,000
Motor Vehicle Retail Business	
Total car and truck dealers	41,200
Total repair shops	97,500
Total retail outlets, duplications eliminated	102,000
Wholesalers	5,900
Retail gasoline outlets	325,000

Automotive Metal Markets

Uncertainty of Labor Situation Brings Anxiety to Steel Industry; Non-Ferrous Metals Continue Firm

By William Crawford Hirsch

Uncertainty as to the extent to which labor troubles may hamper the movement of material from mills into consumers' hands is beginning to cause some anxiety in the steel market. So far, tonnages on which postponement of shipment has been asked, are generally believed to have been negligible, offset to a considerable extent by requests from others not to wait for completion of orders, but to ship piecemeal whatever part of it was ready. Were it not for labor difficulties possibly upsetting production and shipping schedules, the steel market's end-of-the-year outlook could hardly be more serene.

Statisticians estimate 1936 ingot output to have been around 48,000,000 tons, denoting recovery in the demand to near the 1928 level of 50,000,000 tons. Moreover, with operating rates in the first quarter of the year disappointingly light, the progressive improvement from then on, culminating in record-breaking buying by automobile manufacturers a few weeks ago, constitutes an achievement beyond what is ordinarily referred to in the steel market as a good year.

Pig Iron—Following announcement early this week of a 50 cent per ton advance effective Jan. 1 by Eastern Pennsylvania furnaces, the market became generally quotable on the higher basis, the price of malleable and foundry grades advancing to $21, Middle West basing points.

Aluminum—Firmness is noted in the market for both primary and secondary aluminum. Inquiry for piston metal is good.

Copper—While domestic demand for the red metal tapered off, Europeans paid as high as 11⅞ cents, and this gave the market here the imprsesion that 12 cent copper was just around the corner. For the time being, however, 11⅝ cents continued to be producers' quotation. Heavier ore shipments and a resulting quickening of smelter and refinery operations act as a brake on the upsurge. Opinions among producers continue divided as to the best price policy, some being eager to prevent further advances while others deem the time opportune for a mark-up, believing that this would not impair consumption.

SAE Annual Meeting

(*Continued from page 1*)

Factors Affecting Relative Knocking Characteristics of Motor Fuels in Service—JOHN M. CAMPBELL, WHEELER G. LOVELL and T. A. BOYD, General Motors Research Corp.

2:00 p.m. *Truck, Bus and Railcar*

A. GELPKE, Chairman

Rear Engine Clutch and Transmission Developments—C. D. PETERSON, Spicer Manufacturing Corp.

Factors in Engine Temperature Control—H. E. WINKLER, Schwitzer-Cummins Co.

2:00 p.m. *Fuels and Lubricants*

J. B. HILL, Chairman

Development of an Altitude Knock Test Method—W. M. HOLADAY and G. T. MOORE, Standard Oil Company of Indiana.

Influence of Humidity on Knock Ratings—J. R. MACGREGOR, Standard Oil Company of California.

Effect of Knock Intensity on Fuel Knock Ratings—NEIL MACCOULL, The Texas Company.

8:00 p.m. *Junior-Student*

J. J. FREY, Chairman

Electrical Control of Industrial Units—RALPH POWERS, Electronic Control Corp.

Engineer's Social Responsibility — DR. JAMES S. THOMAS, Chrysler Institute of Engineering and Clarkson College of Technology.

Tuesday, Jan. 12

10:00 a.m. *Tourist Trailers*

A. G. HERRESHOFF, Chairman

Where Is the Trailer Going?—PHILIP H. SMITH, Pawling, New York.

2:00 p.m. *Diesel Engine*

F. M. YOUNG, Chairman

Correction of Diesel Engine Performance for Changes in Atmospheric Conditions—C. FAYETTE TAYLOR, Massachusetts Institute of Technology.

Compression-Ignition Engine Performance at Altitude Conditions—C. S. MOORE and J. H. COLLINS, JR., National Advisory Committee for Aeronautics, Langley Field.

Diesel Operation—C. G. ANTHONY, Pacific Freight Lines.

7:45 p.m. *Business Session*

President R. R. TEETOR, in the Chair

Nomination and Election of Members-at-Large of Annual Nominating Committee.

Announcement of Election of Officers for 1937.

Presentation of Life Membership to Past President Roos.

8:00 p.m. *Passenger Car Safety*

MILLER MCCLINTOCK, Chairman

1940?—LIEUT. F. M. KREML, Director, Safety Division, International Association of Chiefs of Police.

Relating Highway Planning to the Traffic Requirements—T. H. MACDONALD, Chief Bureau of Public Roads, Department of Agriculture.

An Automobile Engineer Looks at Safety—W. J. DAVIDSON, General Motors Corp.

Wednesday, Jan. 13

10:00 a.m. *Diesel Engine*

A. W. POPE, JR., Chairman

Diesel Engines in Trucks—B. B. BACHMAN, Autocar Company.

Cetane Numbers, Life Size—LIEUT. COMMANDER R. F. GOOD, U. S. Engineering Experiment Station, Annapolis.

10:00 a.m. *Passenger Car Body Symposium*

R. J. WATERBURY, Chairman

The Aircraft Trend in Body Structural Design—EDWARD G. BUDD, E. G. Budd Manufacturing Co.

The Chassisless or Unit Car Question—STANLEY E. KNAUSS, Motor Coach Division, Gar Wood Industries.

Criticisms from the Aircraft Viewpoint—RALPH UPSON, Consulting Aeronautical Engineer, Detroit.

Modern Body Structure and the Service Problem—HOWARD D. BROWN, General Attorney, Detroit Automobile Inter-Insurance Exchange.

2:00 p.m. *Ring Sticking Symposium*

A. L. BEALL, Chairman

Observations on Cylinder Bore Wear—MAX ROENSCH, Chrysler Corp.

A Mechanical Solution of the Diesel Engine Piston Ring Sticking Problem—A. W. POPE, JR., Waukesha Motor Co.

Engine Temperature as Affecting Lubrication and Ring Sticking—C. G. A. ROSEN, Caterpillar Tractor Co.

The Problem of Ring Sticking in Aviation Engines—O. C. BRIDGEMAN, Bureau of Standards.

8:00 p.m. *Tractor*

A. W. LAVERS, Chairman

The Tractor—Brother to the Automobile—V. P. RUMELY, Hudson Motor Car Co.

The Cavalcade of Farm Mechanization—HARRY G. DAVIS, Director of Research, Farm Equipment Institute.

Thursday, Jan. 14

10:00 a.m. *Passenger Car Engines*

E. H. SMITH, Chairman

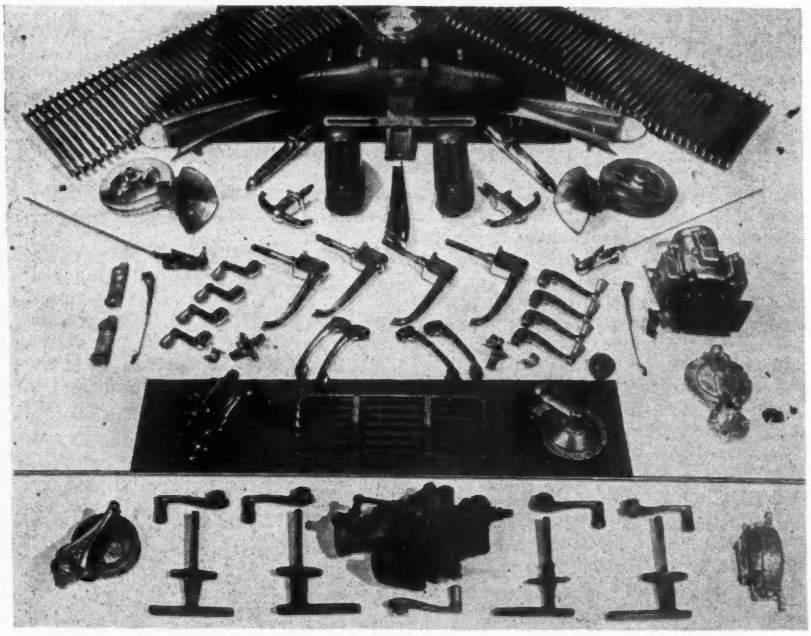
Powerplant Possibilities of the Immediate and the More Remote Future—P. M. HELDT, Engineering Editor, AUTOMOTIVE INDUSTRIES.

2:00 p.m. *Passenger Car Lubrication*

W. S. JAMES, Chairman

Extreme Pressure Lubricants for Hypoid Axle Gears—W. R. GRISWOLD, Packard Motor Car Co.

Zinc-Alloy Die Castings on the Buick



On the Buick for 1937 there are 50 zinc-alloy die castings as shown in the upper part of the illustration. Ten years ago there were only the 12 shown in the lower portion.

2:00 p.m. *Aircraft*
MAC SHORT, Chairman

Spot and Seam Welding the Aluminum Alloys—G. O. HOGLUND, Aluminum Company of America.

Gust Loads on Airplanes—RICHARD V. RHODE, National Advisory Committee for Aeronautics, Langley Field.

Ocean Air Transportation—L. C. MCCARTY, JR., Glenn L. Martin Co.

6:30 p.m. *Dinner*

V. P. RUMELY, Chairman Detroit Section
W. J. DAVIDSON, Toastmaster
K. T. KELLER

The Airship and Its Place in Modern Transportation—DOCTOR HUGO ECKENER, Chairman of the Board, German Zeppelin Transport Company.

R. R. TEETOR, President S. A. E.
H. T. WOOLSON, President-Elect

Presentation of the Vincent Bendix Trophies

Friday, Jan. 15

10:00 a.m. *Aircraft Engines*
OPIE CHENOWETH, Chairman

Aircraft Engine Materials—J. B. JOHNSON, U. S. Army Air Corps, Wright Field.

2:00 p.m. *Aircraft Engines*
ROBERT INSLEY, Chairman

High Output—And How?—VAL CRONSTEDT and R. N. DUBOIS, Aviation Manufacturing Co., Lycoming Division.

The Measurement of Engine Friction—M. K. MCLEOD, Massachusetts Institute of Technology.

8:00 p.m. *Production*
K. L. HERRMANN, Chairman

Developments in Close Machining Practice in Automotive Production—FRED PYPER, Buick Motor Co.

Budgeting Expense and Cost of Handling Materials in Automotive Plants—GEORGE MILLER, Budget Supervisor, Chrysler & Chrysler-Kercheval Plants of Chrysler Corp.

Dodge Truck Salesmen to Meet

Complete outline of the 1937 Dodge truck sales promotion plans will be discussed at dealer meetings in 32 cities from Jan. 4 to 15.

HOWARD E. BLOOD, for several years first vice-president of Borg-Warner Corp., has been appointed executive vice-president in charge of the various divisions of the corporation. His headquarters as executive vice-president will be at the general offices in Chicago. Mr. Blood also remains president of the Norge, the Detroit Gear and Machine and the Detroit Vapor Stove divisions of Borg-Warner and his activities for the latter two divisions will be conducted in Detroit.

S. EDWARD ROWE, formerly chief engineer of the Stutz Motor Car Co. and assistant chief engineer of the Marmon Motor Car Co., has joined the Fruehauf Trailer Co., Detroit, as transportation engineer assigned to the Milwaukee branch.

C. R. KIRKPATRICK has been appointed manager of Cadillac-LaSalle's newly installed used car department. Mr. Kirkpatrick has been in the automobile business since 1913 when he began as a dealer at Evansville, Ind.

O. W. FRANKE has been appointed master mechanic of the Plymouth Motor Corp., succeeding E. J. Hunt.

E. J. HUNT, formerly Plymouth master mechanic, has been advanced to the staff of C. E. Bleicher, staff engineer under K. T. Keller, president of Chrysler Corp.

HARRY J. CARMICHAEL, vice-president and general manager of General Motors of Canada, Ltd., has been appointed to the directorate of the Bank of Toronto, Toronto, Ont.

WARREN HINES, traffic manager of the Chevrolet Motor Car Co., has been elected president of the Motor City Traffic Club for 1937.

J. M. WATSON, who was for many years a metallurgical engineer with the Hupp Motor Car Co., has been appointed an associate in the Detroit district sales office of the Jones & Laughlin Steel Corp.

Delivered Prices Set

Packard and Chrysler Announce Lists Based on New AMA Policy

Delivered prices, f.o.b. factories, including delivery charges, standard accessories and the federal tax, in accordance with the policy adopted by members of the Automobile Manufacturers Association Dec. 17, have been issued by Packard and Chrysler. None of the former prices have been changed; the new practice simply makes it easier for the car buyer to determine what he has to pay for a given model, since all charges except transportation from the factory to the point of delivery are included.

The simplified Packard and Chrysler lists follow:

PACKARD

(Five Wheel Equipment)

Six	At Detroit Del'd	At Detroit F.O.B.	Differ'l Per Cent
Business coupe	$985	$795	+24.0
Sport coupe, 2-4-pass.	940	840	+12.0
Tour. coupe, 5-pass.	960	860	+11.6
Conv. coupe, 2-4-pass.	1,010	910	+11.1
Sedan	995	895	+11.2
Club sedan	1,000	900	+11.2
Tour. sedan	1,010	910	+11.1
One Twenty			
Business coupe	1,065	945	+12.8
Sport coupe	1,110	990	+12.2
Tour. coupe	1,135	1,010	+12.2
Conv. coupe	1,185	1,060	+11.9
Sedan	1,170	1,045	+12.0
Club sedan	1,175	1,050	+12.0
Tour. sedan	1,185	1,060	+11.9
Conv. sedan	1,485	1,355	+ 9.8

(*Turn to page 31, please*)

The South Bend Lathe Works, South Bend, Ind., recently published a 24-page catalog describing its 1937 model 9 in. workshop precision lathe.*

A bulletin entitled "Developments in Modern Drop Forging" has recently been made available by the Chambersburg Engineering Co., Chambersburg, Pa.*

An industrial wiring survey form designed to facilitate investigation of the condition of electrical equipment and wiring in industrial plants from the standpoint of ability to carry load, surplus, or spare capacity, system defects, safety, deterioration and obsolescence, has just been made available by the Anaconda Wire and Cable Co., New York.

McQuay-Norris Mfg. Co., St. Louis, has issued a second edition of the useful booklet entitled "Oil Trouble" by D. M. Smith.*

Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

"5,000,000 Cars in '37"

(*Continued from page 1*)

Retail deliveries of Buick motor cars during the second 10 days of December, totaling 7819 units, set an all-year high and an all-time December record for 10-day periods, W. F. Hufstader, general sales manager, announced. The previous 1936 mark for 10-day period deliveries was in the last period of June, when 7598 Buicks were sold at retail. The new December mark compares with 6672 deliveries during the first 10 days of December and with 4850 units during the second 10 days of December a year ago.

Graham retail sales from Oct. 1 to Dec. 10, 1936, increased 830 cars or 46 per cent over the total for the similar period in 1935, reports F. R. Valpey, vice-president and general sales manager of Graham-Paige Motors Corp.

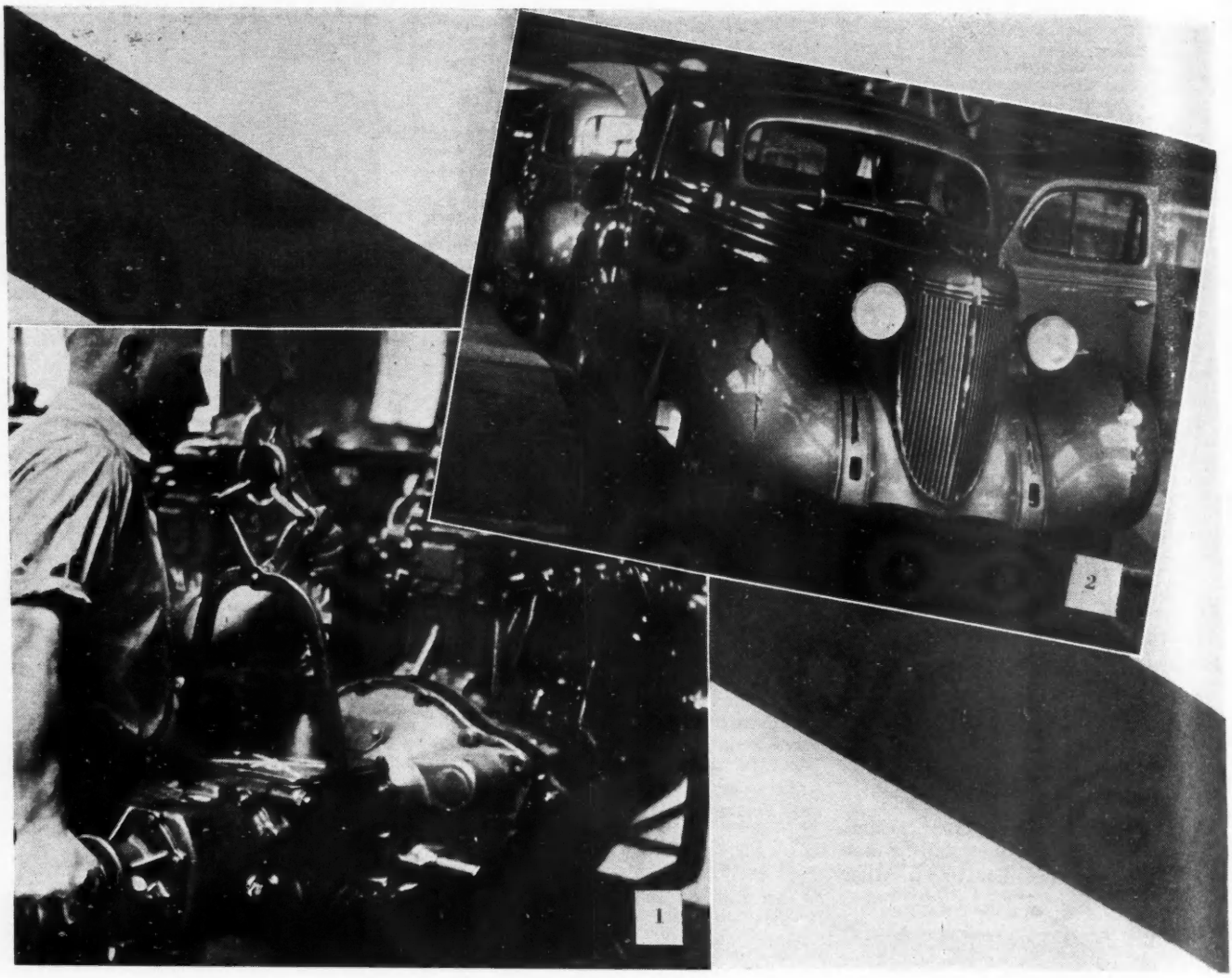
Calendar of Coming Events

SHOWS

National Motor Boat Show, New York, Jan. 8-16
First International Consumers' Petroleum Exposition, Detroit.....Jan. 16-24
Automobile Show, Berlin, Germany, Feb. 20-March 7
Illinois Automotive Ass'n, 4th Annual Show and Maintenance Exhibit, Navy Pier, Chicago .....Apr. 24-28
Second Annual Automotive Maintenance Show, San Francisco..May 20-23
Fourth ASTM Exhibit of Testing Apparatus and Related Equipment, New York .....June 28-July 2
National Automobile Show, New York, Oct. 27-Nov. 3

CONVENTIONS AND MEETINGS

S.A.E. Annual Meeting, Detroit, Mich., Jan. 11-15
American Road Builders Association, Highway Exhibit and Convention, New Orleans .....Jan. 11-15
Tin Can Tourists' Winter Convention, Clearwater, Fla. .....Jan. 29-Feb. 8
Tin Can Tourists' Winter Convention, Sarasota, Fla. .....Feb. 8-14
Association of Highway Officials of No. Atlantic States, 13th Annual Convention, New York .....Feb. 24-26
International Association for Testing Materials, Second International Congress, London, England.April 19-24
American Society for Testing Materials, 1937 Regional Meeting and Committee Week, Palmer House, Chicago, March 1-5
41st Annual Convention and Exposition of the American Foundrymen's Association, Milwaukee, beginning May 2
American Petroleum Institute, Mid-Year Meeting, Colorado Springs, Colo. .....June 1-3
Second World Petroleum Congress, Paris, France .....June 14-19
American Society for Testing Materials, 40th Annual Meeting, New York, June 28-July 2



1. Mounting transmission to complete powerplant assembly. As seen here the engine is in its cradle on the roller conveyor, the transmission being brought over on the ice-tongs bracket suspended from an overhead monorail.

2. 1937 Nash cars coming off the final assembly line at Kenosha.

JUST a few months ago the Nash Motor Co. celebrated its twentieth anniversary of service in the automobile industry with suitable ceremonies at its birthplace in Kenosha, Wis. The occasion was not just a symbol for it also ushered in the most comprehensive plant modernization program in the company's career, a program embracing every branch of its manufacturing activity.

And the handsome line of freshly styled Nash Ambassador Sixes and Eights and the Lafayette 400 are the first fruits of this anniversary planning.

The Nash manufacturing facilities now comprise the main plant in Kenosha boasting a floor space of 1,760,061 sq. ft., the Lafayette 400 plant in Racine with a floor space of 847,474 sq. ft., and the Seaman body plant in Milwaukee with a floor space of 7,000,000 sq. ft.

Examining the factory plan more closely we find that the Kenosha organization houses the foundry and forge shop serving both Kenosha and Racine. The Kenosha engine plant is tooled to build all three engines—the overhead valve eight, the overhead valve six and the L-head six for the Lafayette 400. Kenosha produces the Ambassadors while Racine accounts for the Lafayette 400. The Seaman body plant in Milwaukee, wholly owned by Nash since July, 1936, builds the completely finished bodies for the two assembly plants.

Although Nash has been in business for a long time its factory executives have been very modest concerning the scope of the manufacturing facilities. For example, during the course of our recent visit to Kenosha we were greatly impressed with the fact that the forge shop makes every forging used in the Nash and Lafayette 400 lines with the exception only of the large crankshaft forging. The foundry, one of the most modern in the industry, makes every casting used in the line.

If you add this bit of information to the evidence of the eye gained by a visit through the plants, it becomes quite evident that Nash is one of the most self-contained and self-reliant automobile plants to be found in this great industry.

The new modernization program at Kenosha has added a big five-story building which will be used chiefly as service storage to accommodate the

THIS MONTH'S
PRODUCTION FEATURE

Nash

Twentieth anniversary finds plant one of the most self-contained and self-reliant in the industry

By Joseph Geschelin

complete stock of service parts for all Nash cars in active use today. However, the two most vital products of the activity are the new transmission department and the new metal finishing facilities comprising spray booths, baking ovens, enamel bake, and a Spra-Bonderite installation. This has been supplemented by many new items of equipment at various points as will be described more in detail in later sections of this article.

Since pictures are better than words in a visualization of an automobile plant, we are relying upon a selected group of about 40 photographs to give a perspective of the Nash plant, the majority of the views being taken at Kenosha. In this group will be found not only the general high spots in various departments but many of the new items of equipment as well. For a better appreciation of how the job is done the pictorial section is supplemented by a group of official factory routings indicating both the sequence of operations and the type of equipment on which each operation is performed. These routings comprise the following parts—L-head cylinder block, differential housing, countershaft gear as being typical of the new transmission set-up, crankshaft, and transmission case.

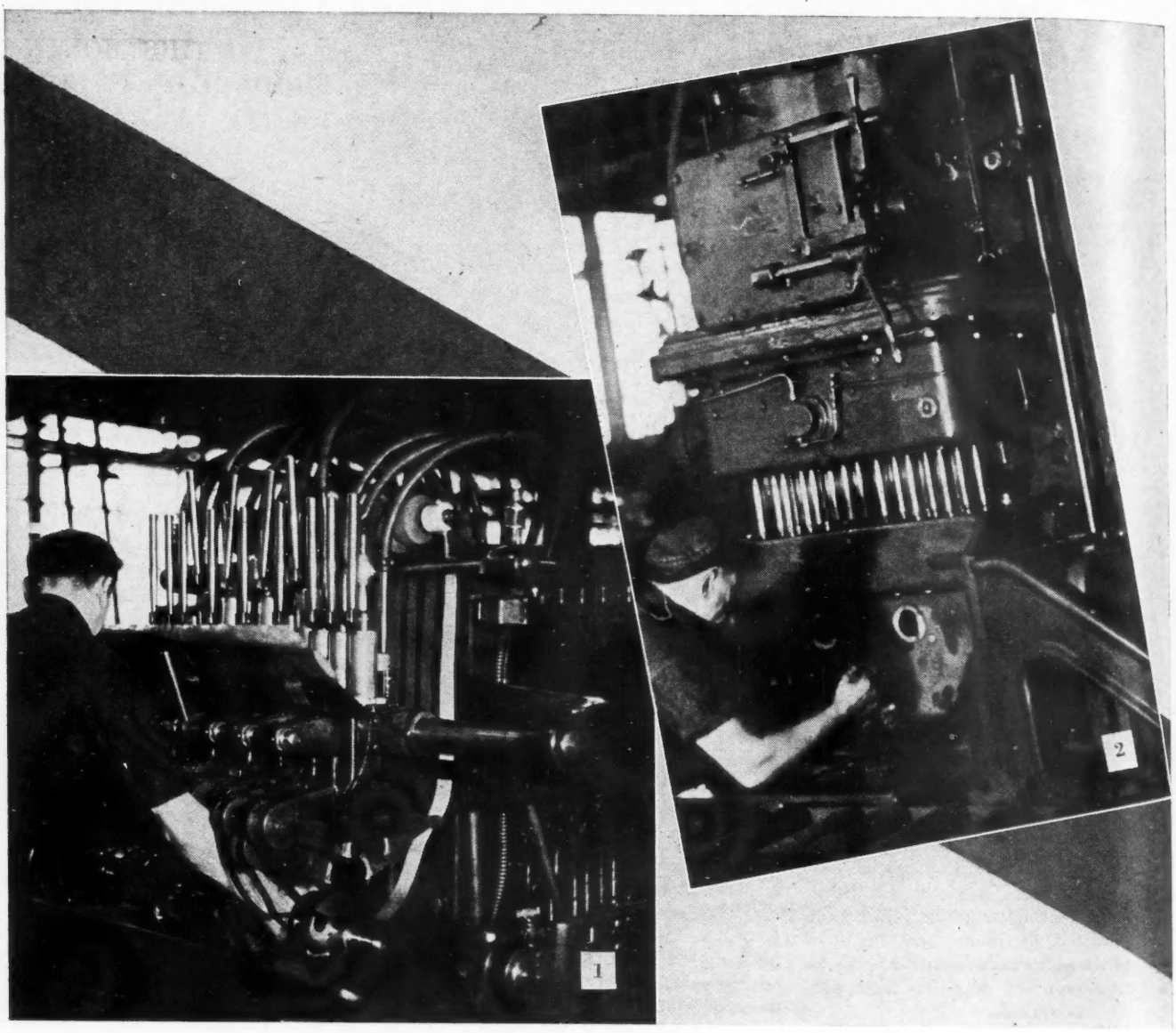
The tabular material is topped off with a list giving the principal factory departments at Kenosha and Racine; also a list giving the factory management personnel so that you may become better acquainted with the men behind the firing line.

So far as the descriptive portion of this article is concerned, we expect to devote most of the space to a discussion of some of the interesting operations in the Kenosha plant as well as to cover many of the new developments in plant equipment resulting from the modernization program. The Seaman body plant was briefly described in AUTOMOTIVE INDUSTRIES a little over a year ago and is essentially unchanged except for the changes in tooling and set-up normally required for new models.

At Kenosha, Nash has a modern cylinder block machining department provided with equipment consistent with production volume. It will be recalled that Nash was the first manufacturer in the industry to adopt surface

Factory Management Personnel

R. B. Elliott	Vice-pres. & Dir. of Manufacturing Activities
D. M. Averill	General Works Manager
R. E. Mainland	Asst. Works Manager
W. G. Helber	Supt., Racine Plant
C. P. Heide	Supt., Kenosha Plant
Wm. Reigg	Div. Supt., Kenosha Plant
Louis Rasmussen	Supt., Kenosha Foundry
Fred McIlrath	Supt., Kenosha Sheet Metal
Fred Benson	Supt., Kenosha and Racine Plants
W. G. Careins	Maint. & Tool Engineer, Racine & Kenosha
John Weiland	Works Manager, Seaman Body



1. Schraner polishing machine is used for lapping crank pins and bearings.

2. Greenlee three-way drill is used for drilling bottom, front, and generator side of both L-head and overhead six-cylinder engine blocks.

broaching of large areas, the largest Cincinnati broaching machine of its kind, at the time, having been installed on the "400" engine block. Other interesting surface broaching operations, including a Foote-Burt vertical machine, also have been in use and will be described more in detail.

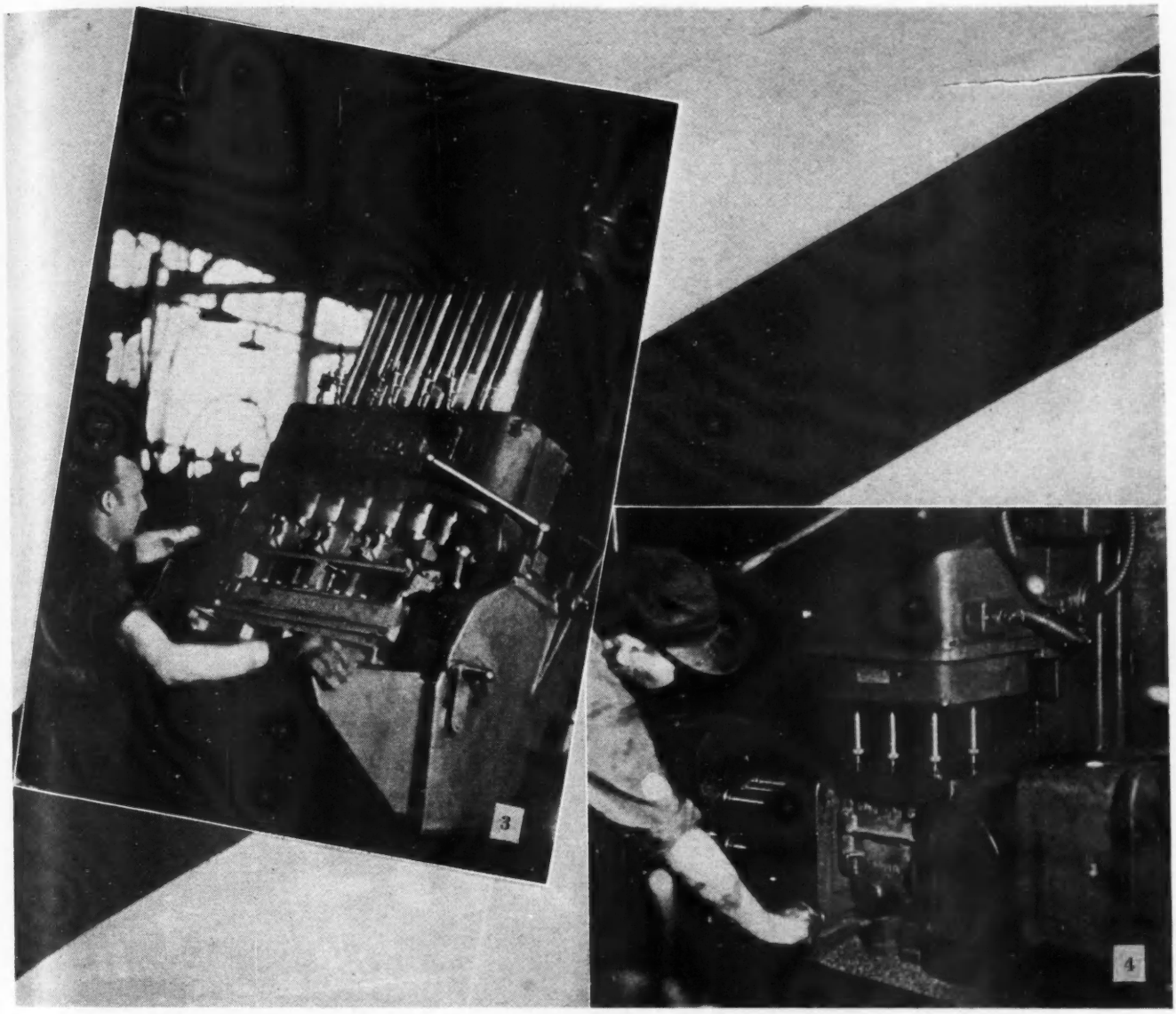
Accenting the unusual degree of cooperation existing between the engineering and production divisions at Nash we find that the mounting dimensions of the L-head six-cylinder engine for the Lafayette 400 and the Nash six-cylinder overhead valve engine for the Nash six are identical. This bit of engineering planning makes it possible to route both blocks over the same machines for a number of important operations. Similarly, bore and stroke for both engines are alike so that the same boring and honing equipment may be used. Quite naturally, the blocks differ in other respects and take different operations at various stages.

However, in the main the cylinder block department is more compact and its functioning much more economical by virtue of running the two higher production blocks over the same lines.

It is profitable to examine this set-up more closely by following the factory routings. For comparison we refer to the details of the routing on the L-head engine. Both blocks go through the first five operations, then the overhead valve block skips the next three. The next group of ten operations is identical for both, the vertical drill head for the oil filler hole being used only for the L-head block. From this point on there is further divergence but all the way through the larger items of equipment such as the Greenlee, Foote-Burt, and Natco multiple-spindle machines as well as the Barnes lappers are used for both. As the routing indicates, Nash blocks feature the double-honing mirror-finish pioneered by Micromatic Hone.

Summarizing the foregoing, we find that the L-head block has 49 major operations as compared with 44 for the overhead block.

The pictorial section shows the big Cincinnati surface broaching machines



3. Cylinder bores are semi-finish bored in one setting on this six-spindle Ingersoll.

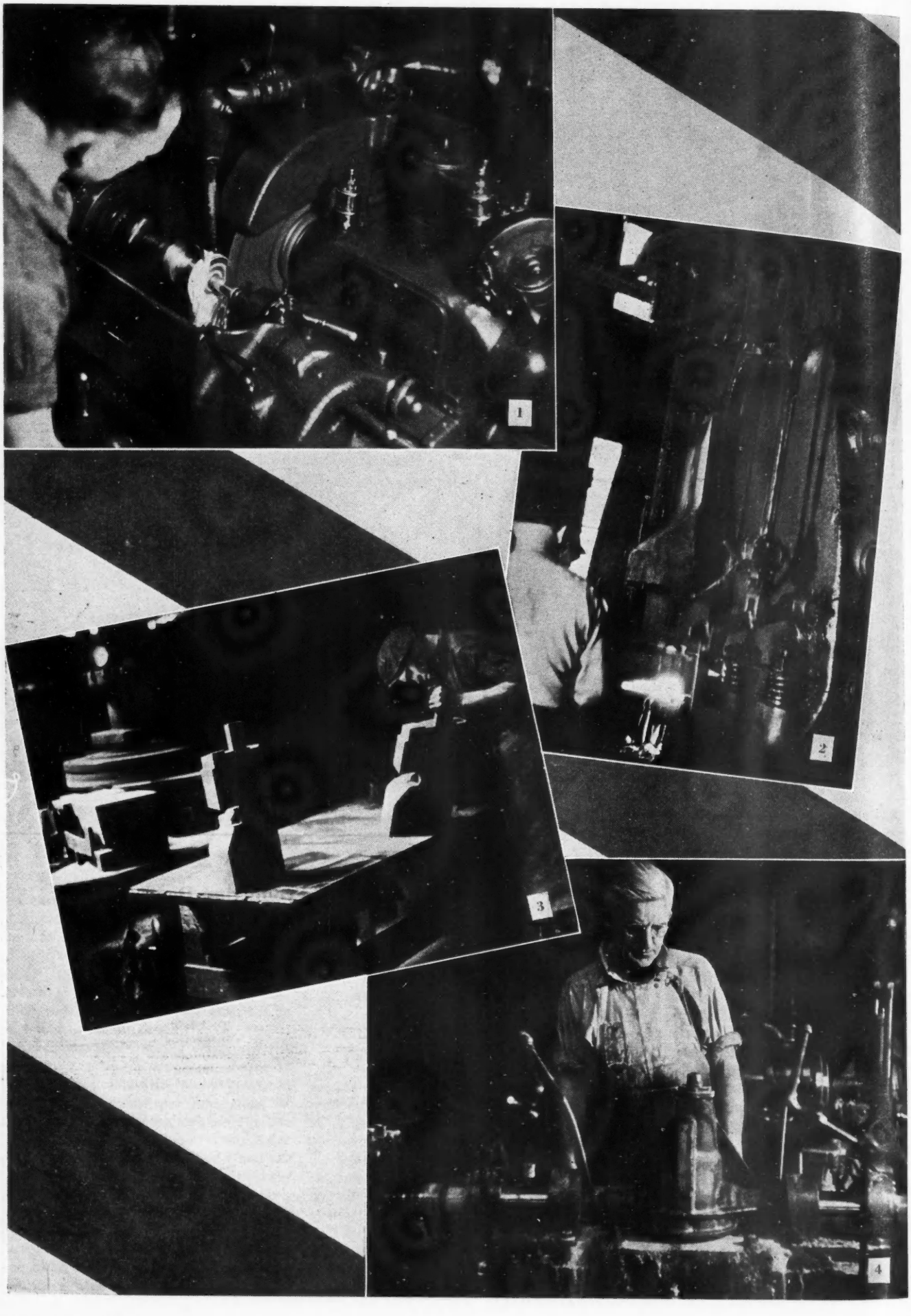
4. Drilling top and both ends of transmission case on Leland-Gifford three-way drilling machine. A similar machine is used for tapping the same holes.

in use here. The first of these is used for broaching the bearing locks in one pass, at a cutting speed of 25 f.p.m. The broaching tool, built-up of H.S.S. inserts, is made by the National Broach & Machine Co., and is said to be good for an average of 3000 blocks per grind.

The larger of the two machines, also made by Cincinnati, and the biggest of its kind when first installed, has a special combination broach in which the flat section takes the valve cover face, oil manifold, and fuel pump face, while the semi-circular tool finishes the ex-

Nash—Principal Production Departments

Kenosha Plant	Racine Plant
Foundry	Motor Mfg. & Test
Forge	Transmission
Press & Sheet Metal	Chassis Assembly
Cyl. Block & Head	Final Assembly
Cam and Crankshaft	Paint & Enamel
Automatic	Press & Sheet Metal
Bevel Gear	Tool Mfr.
Misc. Machining	Inspection
Transmission	Maintenance
Heat Treat	Shipping
Paint & Japan	Material Receiving
Engine Assembly & Test	
Frame & Chassis Assembly	
Final Assembly	
Final Test	
Laboratory	
Mfg. Engineer	
Tool Mfr.	
Inspection	
Shipping	
Maintenance	
Material Receiving	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haust manifold parts. The latter is actually a full-diameter tool arranged to be indexed 180 deg. as one side wears. The tool for the flat sections is 6¾ x 12 x 84½ in. consisting of a series of inserted blades with wedge clamps and is made by National Broach. Production rate is 38 blocks per hour, with a ram speed, cutting, of 25 f.p.m. The broaches are said to be good for 3000 blocks between grinds and a tool life of 20,000 blocks before replacement. The broach used at present is considered to be one of the largest used anywhere, scaling about one ton in weight. It is made of Na-Loy steel instead of the H.S.S. customarily used for broaches.

Another interesting surface broaching job is that of forming the entire bearing half and the two gasket faces of main bearing caps in one pass. This is done on a single slide Foote-Burt vertical surface broaching machine fitted with a two-position hand indexing table, permitting the operator to load and unload the work while the ram is in action. Ram speed is 36 f.p.m. Broach life is said to be 16,000 caps per grind on the average.

One of the new items of equipment placed in operation this season is the Clearing double-action press which is being used on the new front fender. The press is rated at 650 tons and weighs over 200,000 pounds in welded steel construction. The photograph shows the press before installation, the height above the floor line being 280 in. An unusual feature of the press is the use of two dial gages, shown at the right, giving the position of the outer and inner slides respectively so that die adjustment may be made with almost micrometer precision.

New welding techniques are being given a chance to do their stuff. Here for example is a new National Welding Machine seam welder for the gas tanks. It is fully automatic with hand indexing of the work. In this machine, the work is held in a fixture and indexed around by means of a curved rail on the table. The welding wheels for the machine are made of "Elkalloy," a special high conductivity welding alloy made by P. R. Mallory & Co.

The Nash front fender is drawn in two sections which are joined by welding in a short seam across the face of the fender at right angles to the long axis. This is done on Taylor-Winfield flash welders, one for the right fender, the other for the left.

Factory Routing for Cylinder Block—L-Head

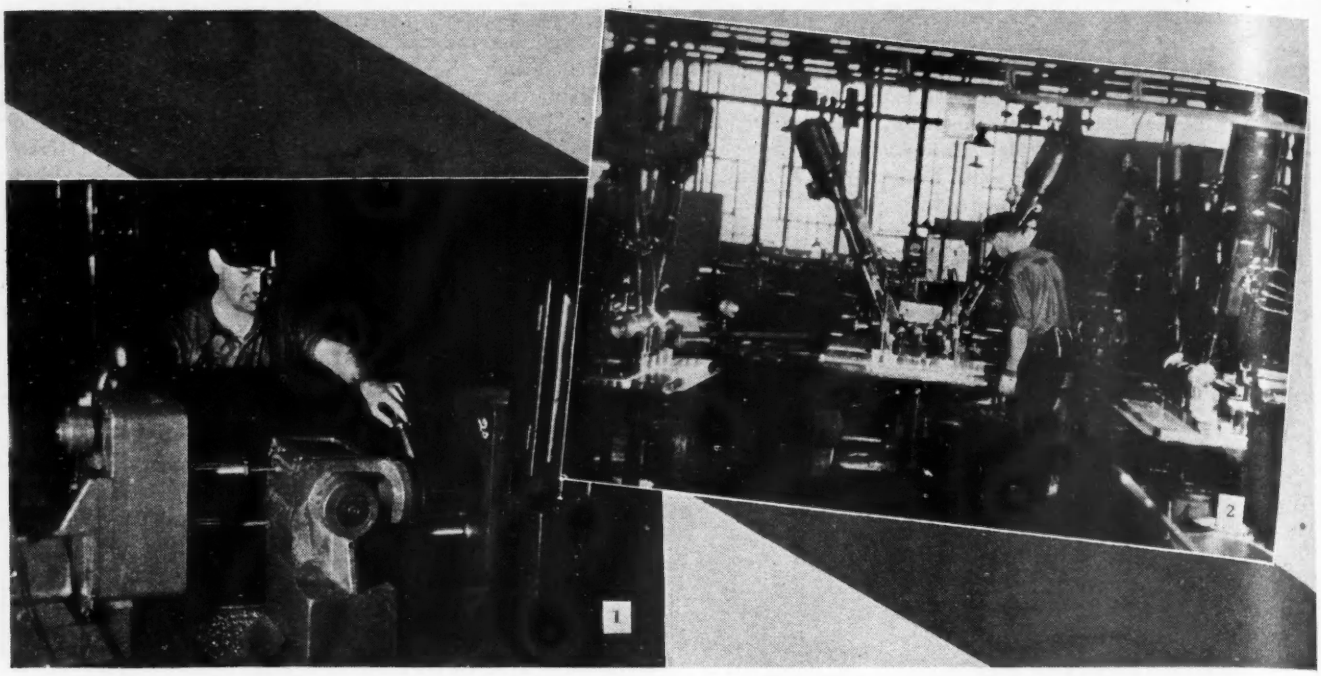
OPERATION	EQUIPMENT
Mill locating pad	Cincinnati Mill
Rough & finish mill top & bottom	Ingersoll Drum Mill
Drill & ream dowel holes	2-spindle Edlund Drill
Rough bore cam & crank holes	Ingersoll Boring Machine
Semi-finish bore crank holes & finish bore cam holes	Ingersoll Boring Machine
Drill valve throats-distributor hole—8 5/16 water holes & generator dowel hole	Rockford Multi-Spindle Drill
Ream distributor hole & chamfer	Aurora Drill
Press in distributor shaft tube	Hannifin Air Press
Broach main bearing locks	Cincinnati Hyd. Surface Broach
Rough bore cylinders	Ingersoll 6-spindle Boring Machine
Semi-finish bore cylinders	Ingersoll 6-spindle Boring Machine
Mill ends	Davis & Thompson Drum Mill
Broach valve cover face—exhaust ports—oil manifold & fuel pump face.	Cincinnati Hyd. Surface Broach
Mill notches for bearing shell lock	Special Nash Machine
Straddle mill sides of main bearings	Ingersoll Mill
Mill generator side	Ingersoll Mill
Drill oil gage hole	Leland-Gifford Drill
Counterbore cam & crank holes & drill & ream oil filler hole.	Special Nash Machine with Vertical Drill Head
Finish ream cylinder bores	Baker single sp. Drill Press
Drill top-rear & valve side	Foote-Burt 3-way Drill
Drill manifold to crank bearing oil holes & 1¼ hole in No. 1 cam bearing.	Baker Drill
Tap top & valve side	Natco 2-way Tapper
Drill manifold to cam bearings oil holes & 12-3/16 oil holes to tappet holes	Natco 2-way Drill
Drill bottom front & generator side	Greenlee 3-way Drill
Drill valve tappet holes	Foote-Burt Multi Sp. Drill
Rough ream tappet holes	Moline Multi Sp. Drill
Semi-finish ream tappet holes	Ingersoll Multi Sp. Drill
Countersink main bearing cap screw holes	Natco Multi Sp. Drill
Core drill-ream & tap oil pump stud hole	Kokomo Single Sp. Drill
Back counterbore for valve springs	Natco Multi Sp. Drill
Tap bottom and rear	Foote-Burt Tapper
Finish ream tappet holes & countersink	Natco Multi Sp. Drill & Leland-Gifford Single Sp Drill Head
Drill oil hole from oil pump stud hole to center bearing	Foote-Burt Tapper
Tap front & generator side	Baker Drill
Semi-finish ream valve stem guide holes	Barnes 6-spindle Lapper
Finish bore throats & seat valves	Barnes 6-spindle Lapper
Rough lap bores	Air hose & Niagara Wash Machine
Finish lap bores	Special Nash fixture
Blow out tapped holes & wash	Special gages
Water test	Special gages
Indicate & plug gage bores	On conveyer with hammer & drift
Inspect	On conveyer
Assemble oil pump bushing	Air wrench
Assemble main bearing caps & screws	Special Nash Air Press
Tighten main bearing cap screws	Electric hand drill
Press in cam bearings	Ingersoll Boring Machine
Drill rear cam bearing oil hole	Hannifin Air Press
Finish bore cam & crank bearings	Special gages
Press in valve stem guides	
Inspect	

1. Grinding face of 32-tooth gear on countershaft gear cluster on this Landis grinder.

2. One of the Erie steam hammers caught in action in the Nash forge shop at Kenosha

3. Finishing dry-sand cores in foundry.

4. Garvin Duplex machine boring differential housing.



1. Natco two-way drill takes five odd holes in transmission case.

2. View of battery of Leland-Gifford crankshaft oil - hole drilling machines fitted with the hydraulic step-by-step feed mechanism.

Action pictures of the welders mentioned above will be found in the pictorial section.

A rather unusual multiple-head machine which has been in use here for some time is a Natco three-way horizontal boring machine for machining the rear axle center (differential housing) at the rate of about 45 pieces per hour. It is a three-way hydraulic feed machine built up of three Natco Hole units and a four-position trunnion type fixture. All have semi-automatic hydraulic feeds and, in addition, the right and left hand units are equipped with automatic time delay reverse mechanism and positive stops. The operator has complete control of the machine through a centralized push-button station. He starts the head cycles by pressing a single push button after he has unloaded a finished part, reloaded a new part and indexed the trunnion type fixture 90 degrees to the new station.

The sequence of operations is as follows:

POSITION No. 1:

Unload one finished piece and load new piece into fixture.

POSITION No. 2:

Left Hand Head—Combination rough bore the 2.8588/2.8598 diameter and chamfer same 1/16 in. x 45 deg.

Right Hand Head — Combination rough bore the 2.8588/2.8598 diameter and the 2.997/2.999 diameter and chamfer the latter 1/16 in. x 45 deg.

Rear Head—Combination rough bore the 2.473/2.475 diameter and chamfer same to 1/16 in. x 45 deg.

POSITION No. 3:

Left Hand Head—Semi-finish bore the 2.8588/2.8598 diameter. Drill 10 holes for ⅜ x 16 tap. Drill four holes for 7/16 x 14 tap.

Right Hand Head—Semi-finish bore the 2.8588/2.8598 and the 2.997/2.999 diameter.

Rear Head—Idle.

POSITION No. 4:

Left Hand Head—Finish bore the 2.8588/2.8598 diameter.

Right Hand Head—Finish bore the 2.8588/2.8598 and the 2.997/2.999 diameter.

Rear Head—Combination rough bore the 2.473/2.475 diameter and chamfer 1/16 x 45 deg.

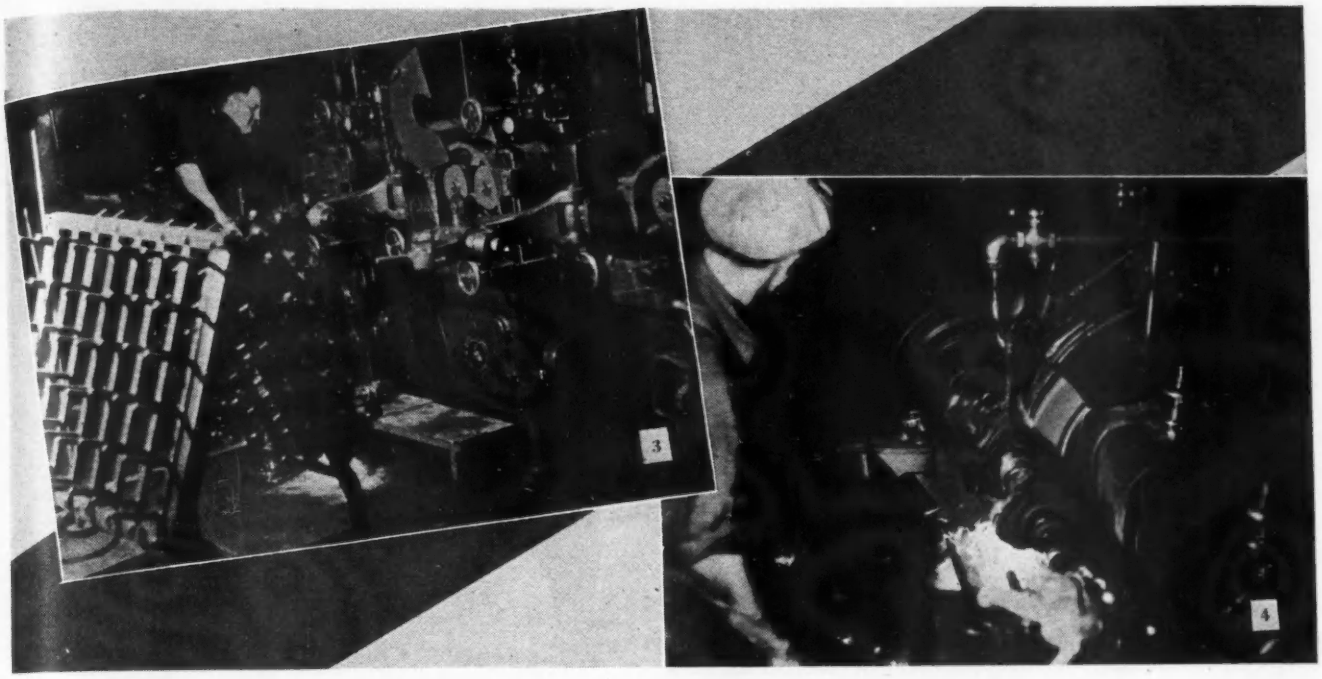
The complete routing of the differential housing is found in the detailed factory routing shown elsewhere in this article.

Transmission Department

Nineteen thirty-seven transmissions have been completely redesigned to take advantage of current production methods and new design features such as the improved synchronizing clutch mechanism. In consequence, transmissions for the big cars are much smaller units and represent a saving in weight of almost 80 pounds.

The detail factory routing on the new countershaft gear was taken as a typical example of the method of finishing transmission gear tooth form. In the development of this particular set-up, Nash continues the use of some of the former equipment. Thus the Barber-Colman hobbers are used for rough-hobbing gear teeth and Fellows Gear Shapers for semi-finish of tooth form. A noteworthy practice started this season is that of completing the tooth form by rough-shaving and finish-shaving as indicated on the routing. For this purpose Nash has installed a battery of five Model GCC ring gear finishers, the machines being used interchangeably for rough or finish-shaving by changing cutters.

Nash has found that shaved gears retain their form better through the heat treating operations, due to the fact that shaving reduces tool pressure strains in the metal and thus eliminates the customary rebound under fire. It is an interesting feature of the shaving operation that the chips from the special cutting tool are about 0.0025 in. in



3. **Battery of Fellows gear lappers in transmission department.**

4. **Rough-grinding crankshaft center bearing on Norton grinder.**

thickness, twisted lengthwise, and having the appearance of a fine mineral wool. Finish-shaving requires about one minute.

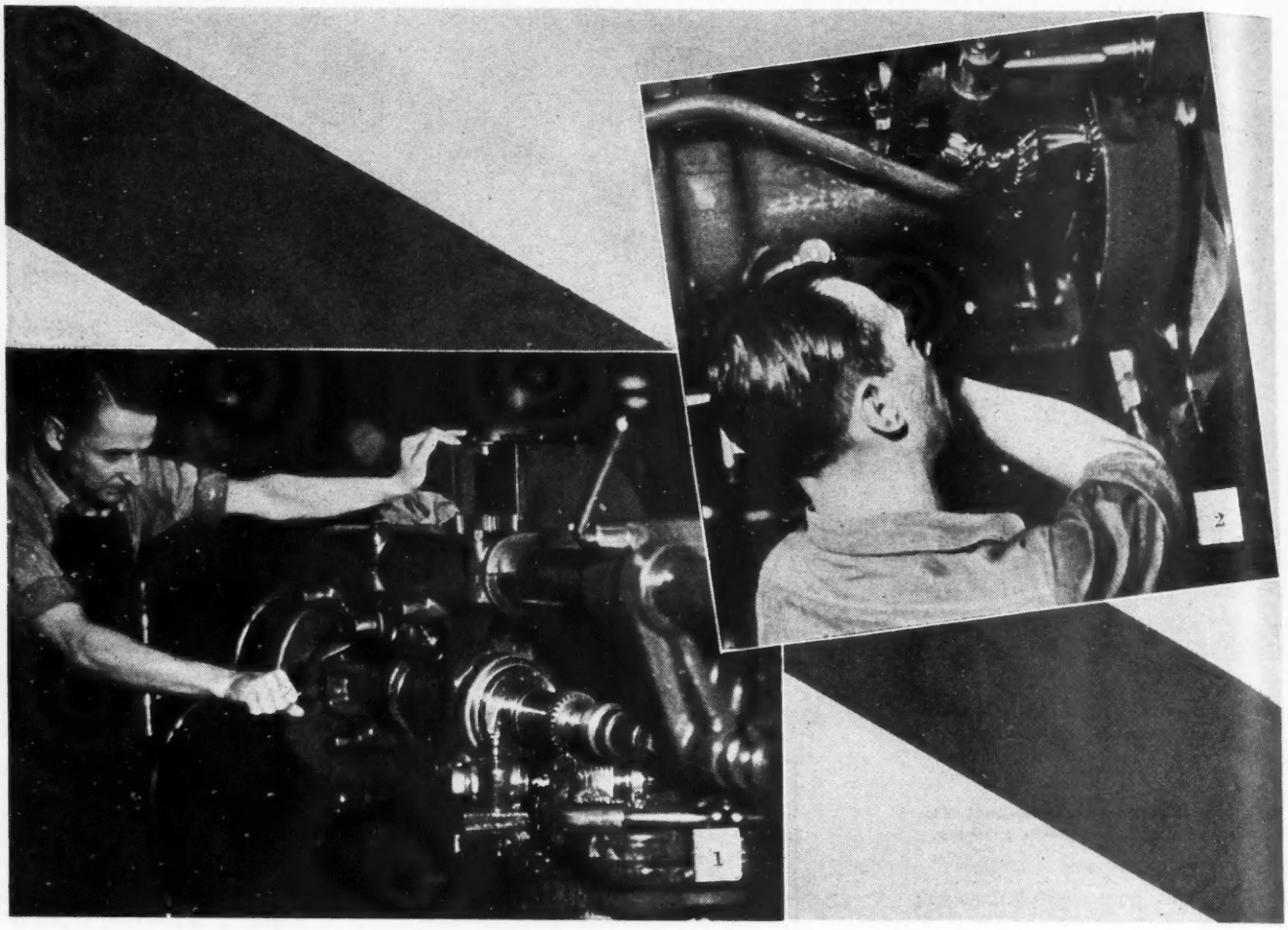
The National shaving machines are provided with a table so designed as to permit the crowning of the gear face, producing a bearing only at the mid-section of the gear tooth, with the edges relieved. This further assists in preventing distortion in heat treat and promotes quiet operation. It is necessary to crown only one gear of each pair in this fashion.

To prevent any possibility of accidental disengagement when gears are under load, the mating teeth in the clutch collar and gear ends are tapered at an angle of two degrees or less so as to produce a definite clamping action. This is a reverse taper with the thicker edge on the end of the tooth face.

Another new piece of equipment in this department is a No. 49 Heald Bore-Matic which is used for the precision boring of bronze-bushed gears. It takes a complete set of such gears in one chucking, two different gears being chucked in the back chuck—one at each end, while the cluster gear is inserted through the front fixture. The machine is fitted with a Garrison chuck.

Factory Routing for Crankshaft

OPERATION	EQUIPMENT
Rough turn Nos. 3-4-5 bearings	4-AC-LeBlond
Straighten	General Flexible Press
Rough grind center bearing	Norton Grinder
Rough turn front end-flange & Nos. 2 & 6 bearings	4-AC-LeBlond
Straighten	General Flexible Press
Rough grind front bearing	Norton Grinder
Rough grind rear bearing	Norton Grinder
Shave Nos. 2-3-5 & 6 bearings	4-AC-LeBlond
Mill locating spots	Cincinnati Hydro. Mill
Rough turn all pins	5-AC-LeBlond
Straighten	General Flexible Press
Rough grind 1 & 6 pins	Norton Grinder
Rough grind 2 & 5 pins	Norton Grinder
Rough grind 3 & 4 pins	Norton Grinder
Mill 23/32 Rad. clearance in flange	Barnes Drill
Drill oil holes in Nos. 1 & 6 pins	Leland-Gifford 2-spindle Drill
Drill oil holes in Nos. 2 & 5 pins	Leland-Gifford 2-spindle Drill
Drill oil holes in Nos. 3 & 4 pins	Leland-Gifford 2-spindle Drill
Drill 2—1¼ holes in counterweights	Moline 2-way Drill
Drill 4—29/64 holes in flange	Aurora Drill
Drill 6 holes through pins	Barnes 2-way Drill
Straighten	General Flexible Press
Finish face flange	No. 6 Warner & Swasey
Countersink & tap 4 flange holes	Hoefer Tapping Machine
Ream 6 oil holes in pins	Leland-Gifford Drill
Assemble oil tubes	Bench
Finish grind 1 & 6 pins	Norton Grinder
Finish grind 2 & 5 pins	Norton Grinder
Finish grind 3 & 4 pins	Norton Grinder
Straighten	Hand Press
Finish grind center bearing to width	Norton Grinder
Finish grind center bearing	Landis Grinder
Finish grind front bearing	Landis Grinder
Finish grind rear bearing	Norton Grinder
Finish grind 2-3-5-6 bearings	Norton Grinder
Finish grind flange	Norton Grinder
Finish grind gear end	Norton Grinder
Cut oil thread	Barnes Lathe
Drill bore & ream rear end & assemble bushing	No. 6 Warner & Swasey
Face to length & thread front end	No. 6 Warner & Swasey
Mill 2 keyways	18 in. Cincinnati Mill
Straighten	General Flexible Press
Wash	Wash tank & air hoist
Polish	Schraner Polishing Machine



1. Rough - hobbing 32 - tooth countershaft cluster gear on this Barber - Colman hobbing machine.

2. Semi - finish tooth form, countershaft gear, on one of battery of Fellows gear shapers.

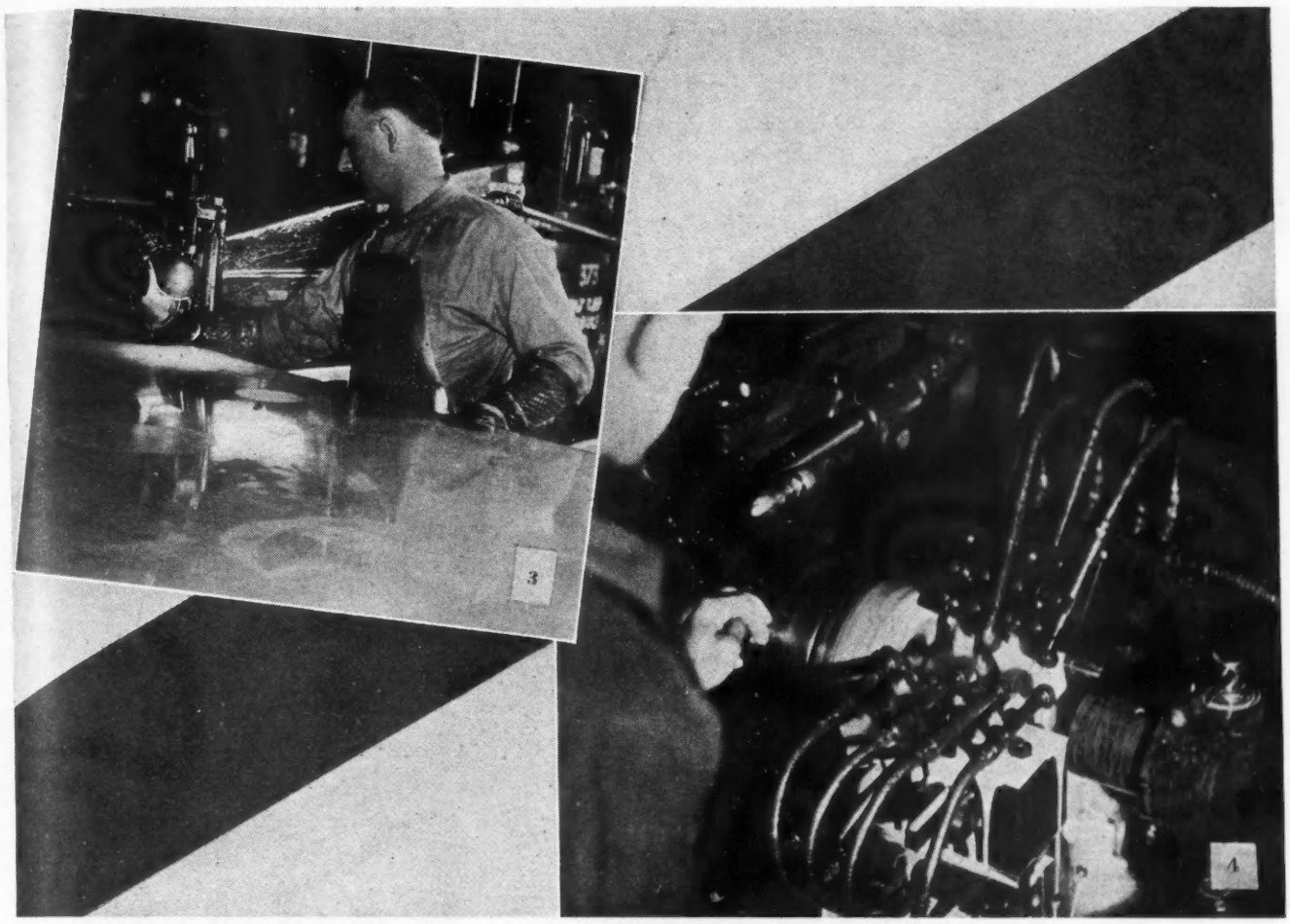
Factory Routing—Differential Housing

OPERATION	EQUIPMENT
Mill bottom face	2-spindle Newton Rotary Mill
Drill & ream 2 locating holes	2-spindle Avey Drill
Rough bore 2 tube holes Rough and finish bore & ream Pinion shaft hole-drill 10 flange & 4 brg. cap screw holes	Natco 3-way
Mill 4 brg. cap screw bosses	No. 2 Milwaukee Mill
Burr 14 holes	Hand air drill
Tap 4—Brg. cap screw holes & 10 flange holes	Fox Multi Sp. Tapper
Press bearings in pinion shaft holes	Hannifin Air Press
Assemble bearing caps	Bench & air wrench
Finish bore tube holes	Rockford 2-way Boring Machine
Mill threads	Hall Planetary Thread Mill
Rough & finish bore differential bearing bores	Barnes 2-spindle Boring Machine
Drill & tap 1/4-20 hole	Single Spindle Leland - Gifford Drill

The precision boring method has definitely obsoleted internal grinding in the new set-up and is said to produce a better hole with much improved productivity.

Nash has a really outstanding procedure for transmission gear checking to assure quiet running units. In checking gear cutter set-up they run the sample gears in Red Ring sound testers both for bearing and tone, the gears being cut in a definitely distorted form to anticipate the changes that take place in heat treatment. This takes care of gears in the green. After heat treatment, the gears are mated in pairs and run in the sound testers to assure accurate matching. Periodically, individual gears are run in the sound testers against true master gears as a check on the production set-up.

The pictorial section shows part of a



3. Quickwork shear used for cutting sheets in sheet metal department.

4. Rough and finish-turn countershaft cluster gear blank on Fay automatic lathe.

battery of Fellows gear lappers which are used in the transmission department.

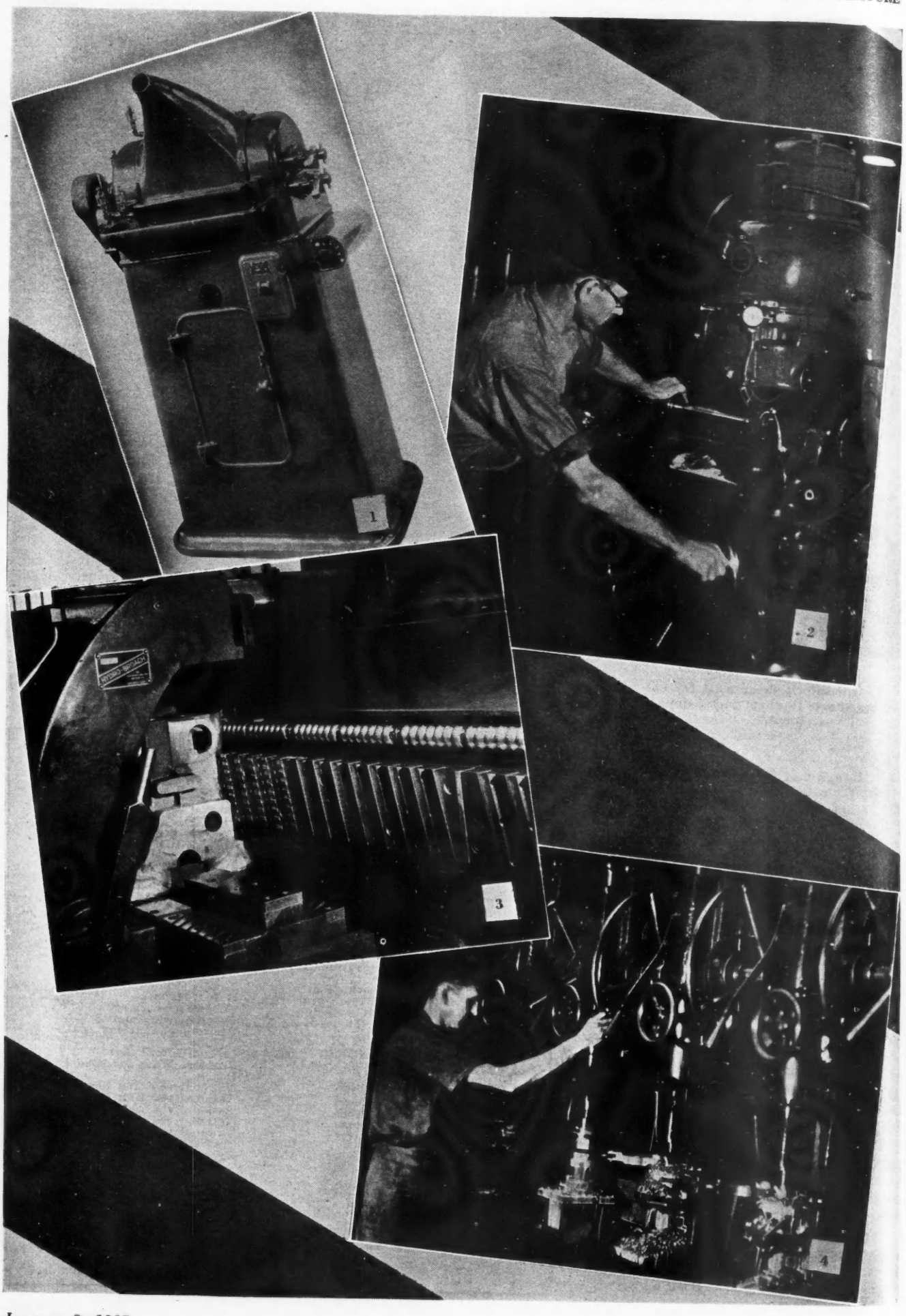
Miscellaneous Details

In preparation for 1937 business Nash has made some very significant changes in practically every corner of the Kenosha plant. Perhaps the most extensive of these concern the facilities for finishing and painting sheet metal—fenders, hoods, splashers, etc. There is now a modern sheet metal department with excellent facilities for metal finish in the white. There is a huge A-oven for baking sheet metal supplementing a battery of new ovens for undercoats and finish paint.

The now familiar Spra-Bonderite process is used for producing the corrosion-resistant metal coating on the

Factory Routing—Countershaft Gear

OPERATION	EQUIPMENT
Drill countershaft hole	4-spindle Baker Drill
Rough-spot face both ends	No. 4 Warner & Swasey
Broach hole	Oil gear broach
Face to length & chamfer both ends	Barnes 2-spindle Drill
Rough & finish face-turn & chamfer & undercut 32 tooth gear	Fay Lathe
Rough hob 32 tooth gear	Barber-Colman Hobber
Rough turn & race remainder of gear	Fay Lathe
Finish turn & race remainder of gear	Fay Lathe
Grind face of 32 tooth gear	Landis Grinder
Semi-finish hob 25 tooth gear	G & E Hobber
Semi-finish shape 19 teeth	Fellows gear shaper
Semi-finish shape 14 teeth	Fellows gear shaper
Chamfer 19 teeth	Peerless chamfering machine
Drill 5/16 oil hole	Leland-Gifford Drill
Wash	Crescent Wash Machine
File burrs	Bench
Rough shave 32 teeth	National red ring Shaver
Finish shave 32 teeth	National red ring Shaver
Finish shave 25 teeth	National red ring Shaver
Finish shave 19 teeth	National red ring Shaver
Finish shave 14 teeth	National red ring Shaver
Wash	Crescent Wash Machine
Inspect	Bench
Heat treat	
Press in bushing	Hannifin air press
Swedge Broach bushings	General Flexible press
Finish bore bushings	Heald bore-Matic
Grind both ends to length	Heald vertical grinder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1. Exterior view of National Red Ring Model GSB gear sound tester which is used in testing transmission gears before and after heat treatment

2. National Red Ring gear shaver in action finish-shaving transmission gear.

3. Huge Cincinnati horizontal Hydro-Broach finishes entire side of block including semi-circular section for exhaust manifold ports.

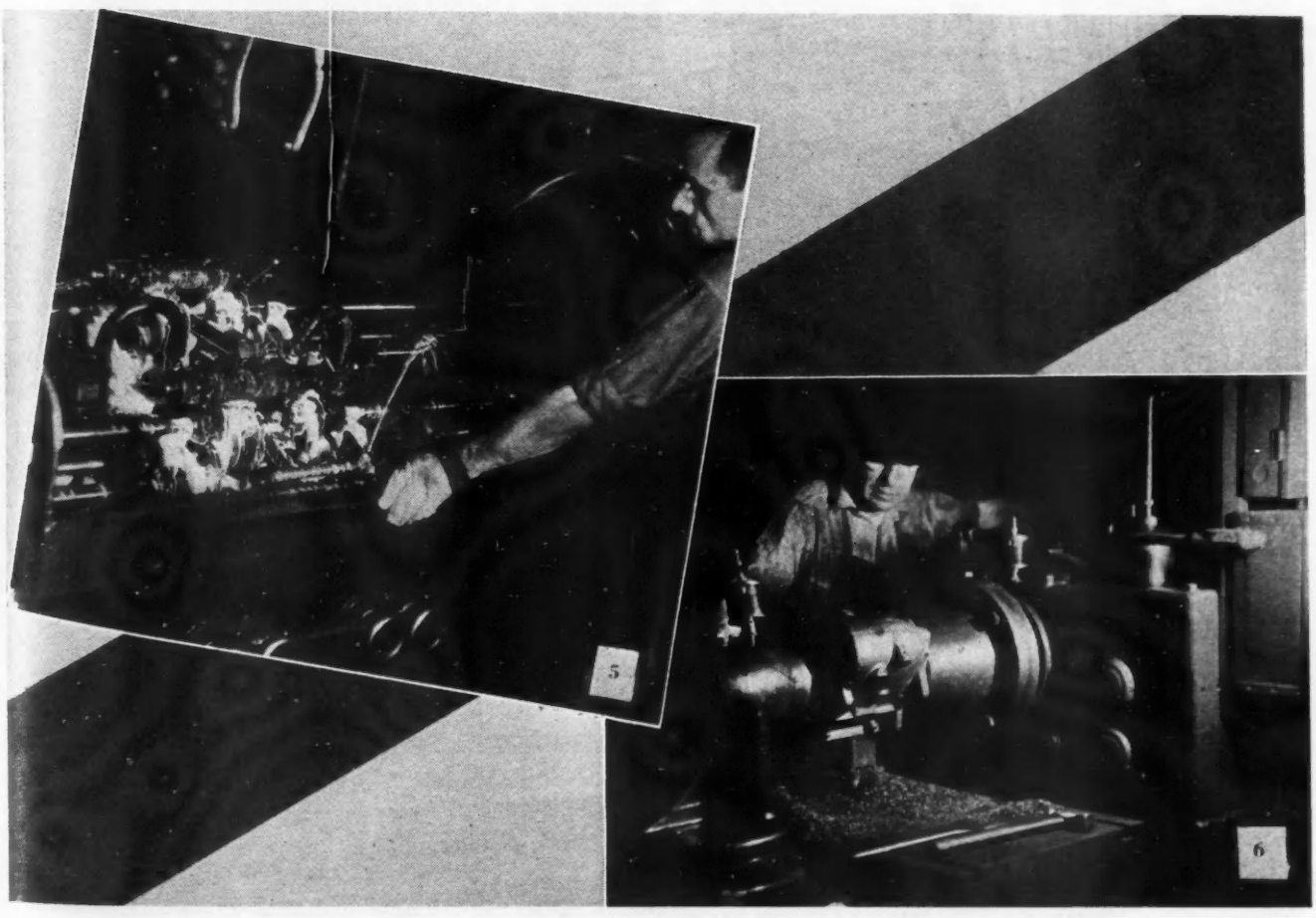
4. Four-spindle Baker drill used for drilling countershaft gear hole.

5. Close-up of two-way Barnes drill used for drilling 6 holes through crankshaft pins.

6. Potter & Johnston turret lathe finish-facing both ends of transmission case

Factory Routing—Transmission Case

OPERATION	EQUIPMENT
Mill top & both ends	Ingersoll Mill
Rough & finish bore & semi-finish Ream main shaft & countershaft hole	Rockford 2-way Boring Machine
Line ream main shaft hole	Snyder Drill
Finish face both ends	Potter & Johnston Turret Lathe
Chamfer main shaft & countershaft holes	Hand Tool
Drill & ream interlock hole	2-spindle Avey Drill
Drill top & both ends	Leland - Gifford 3 - way Drill
Tap top & both ends	Leland - Gifford 3 - way Tapper
Drill & rough ream reverse idler hole	Cincinnati Drill
Drill ream & counterbore shift rail bushing hole	Barnes Drill
Drill 1—3/16 hole	Leland-Gifford
Drill 1—21/32 & semi ream .618 hole	Wisconsin Radial
Face inside of reverse idler shaft hole	Special Nash Machine
Face inside of countershaft hole	Garvin Duplex Drill
Straddle mill fulcrum pads	Cincinnati Duplex Mill
Drill 2—23/32 pipe tap holes, 2—1/2 fulcrum holes and 1—21/64 holes	Natco 2-way Drill
Tap 2—1/2 pipe tap holes, 2—9/16-18, 2—7/16-14 and chamfer 2—9/16-18 holes	American Radial Drill
Press in shift rail bushing	Arbor Press
Line ream countershaft reverse idler & shift rail holes.	Special reaming fixture
Wash	Niagara Wash Machine
Inspect	Bench



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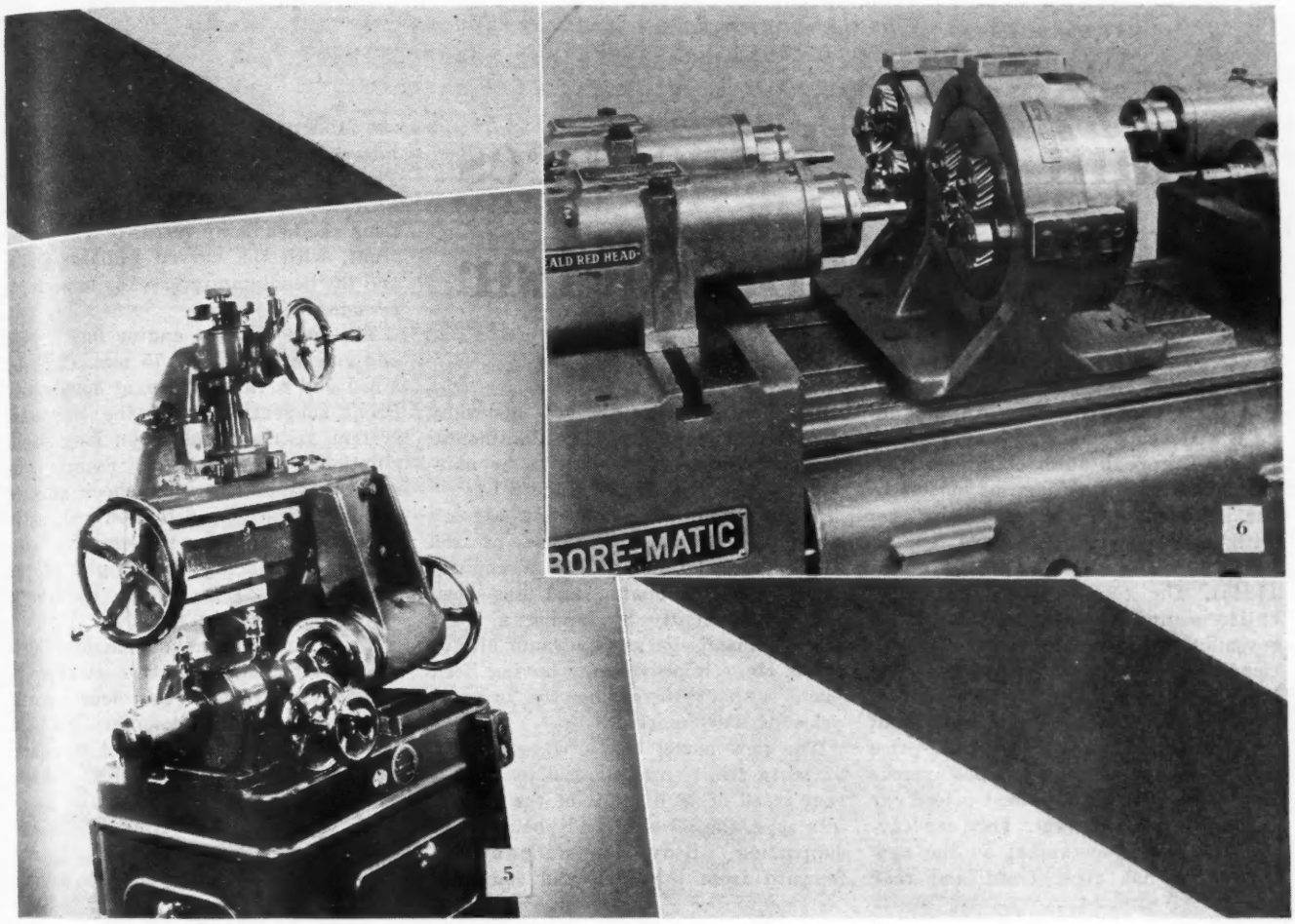


5. This Red Ring machine was converted for use as an internal shaving machine.

6. New Heald Bore-Matic Model 49 is used for precision boring of bronze-bushed transmission gears. It is fitted with a Garrison work-holding chuck.

exterior metal sheet. This unit is about 203 ft. long and consists of three distinct stages—wash, Bonderize, and dry-off. The washer is made up of three stages, two rinses and an alkaline cleaner. The Bonderize section also is made up in three stages—Bonderize with a series of 90 Roto-jet nozzles for spraying the solution, a hot rinse, and an acidified rinse.

Coincident with the sheet metal and paint shop developments, there is a large installation of new monorail conveyors for handling the large sheet metal parts in transporting to various departments as well as through the Spra-Bonderite and the baking ovens.

Some changes have been made along the various assembly lines with probably more detail changes for handling engine and powerplant assembly. It is of more than passing interest to note that Nash engines are run-in in a unique fashion quite different from the usual practice for passenger car engines. For run-in the engines are assembled without pans so that the entire underside is exposed. Then the engines are mounted on stands fitted with pans corresponding with the engine pan. The engine lubricant is piped to the test stand pans from a central lubricating system in which the oil is cooled, filtered and centrifuged, and this material is carried through the test engines.

After the run-in the engine is lifted from the test stand and proceeds to an inspection station for a final check on its condition. Following this the engine goes back to an assembly station to be fitted with the oil pan. This procedure, although admittedly rather expensive, assures an engine job that is as close to perfection as is practical to approach in mass production. For one thing, the engine starts with clean oil and as the oil becomes contaminated with foreign material during the course of breaking-in, the oil is drawn out and centrifuged to remove all such foreign matter. Finally, when the engine is taken off the test stand none of the break-in lubricant remains, and what is more important, nothing can remain in the pan to cause trouble in service.

1. Intimate view of Cincinnati surface broaching machine used for cutting bearing locks in six-cylinder blocks.

2. New Clearing press of welded construction is rated at 650 tons and weighs 200,000 pounds. View shows press being installed in pit.

3. View showing business end of Foote-Burt single slide vertical surface broaching machine used for finishing the entire inside surface of bearing caps. The two-position hand indexing fixture and elaborate broaching tool made by National Broach are shown here to great advantage.

4. Close-up of new National Welding Machines seam welder for welding gas tank. The work-holding fixture is indexed by a guide rail on the table.

Adam Opel Introduces New 23 hp. "Baby" Car

ADAM OPEL CO., General Motors' German subsidiary and largest European automobile plant, has just augmented its range of models by the introduction of a new "baby" car with a four-cylinder L-head engine, which is being offered at 2100 marks ($845). The company is revising its entire manufacturing program in accordance with changed market conditions. The new model seems to be intended to supersede the well-known Opel Model P 4, brought out about this time last year, on which the price was recently reduced to 1450 marks and which is now the lowest-priced car on the German market. This car carries the same powerplant as the new model but has rigid front and rear axles, features that are now generally considered obsolete in Continental Europe. The new model is to be marketed under the name "Kadett."

Chassis features of the new car are almost identical with those of the Olympia model, which has a slightly more powerful engine and has been improved recently by having a four-speed transmission and hydraulic brakes fitted, these improvements having been made without increasing the original price of 2500 marks.

The new model has a wheelbase of 92 in., a front tread of 42.3 in., and a rear tread of 46 in. It is of the frameless type, the all-steel body being self-supporting. Body side walls extend forward from the dash and comprise the fenders and the aprons between the latter and the engine compartment. The hood, which is hinged at the center, has side sections extending back from the headlamp recesses. The entire front, with the curved radiator grille and the headlamp recesses is in a single pressing.

The four-cylinder engine has a bore and stroke of 67.5 by 75 mm. (2.70 by 3 in.) and is rated 23 hp. at 3500 r.p.m. Front suspension is by the Dubonnet system, rear suspension on long semi-elliptic springs, and to reduce side sway the rear hydraulic shock absorbers are coupled by a torsion rod, as in other Opel cars. The makers have succeeded in reducing the weight of the Kadett to 1620 lb., which assures a good output/weight ratio.

Articles of equipment include adjustable front seats, electric semaphore signals fitted to front-door posts, speedometer with odometer, oil and gas gage, light switch, foot dimming switch, and rear-view mirror. Wheels are of the spoked disk type and carry 4½-in. tires on 16-in. rims. The maximum speed is given as 50 m.p.h. and the fuel mileage as 29 per U. S. gallon.

Self - supporting body of the new Opel Kadett

COOLING AND IGNITION SYSTEMS

Line Number	CAR MAKE AND MODEL	Circulation Type	WATER PUMP Type	WATER PUMP Drive	Thermostat—Make	By-pass for recirculation	RADIATOR Shutters Make	RADIATOR Shutters Control	RADIATOR Core Type	RADIATOR Core Make	RADIATOR Lower Hose Inside Diameter	RADIATOR Lower Hose Length	RADIATOR Upper Hose Inside Diameter	RADIATOR Upper Hose Length	Cooling System Capacity (Quarts)	Full Length Waterjackets	FAN BELT Number Used	FAN BELT Type	FAN BELT Length—Outside	FAN BELT Width	FAN BELT Make	Make of Fan	IGNITION UNIT Make	IGNITION UNIT MODEL	IGNITION UNIT Degrees Advanced Manual	IGNITION UNIT Degrees Advanced Automatic	IGNITION UNIT Degrees Advanced Vacuum	IGNITION UNIT Breaker Gap	IGNITION UNIT Timing Spark Occurs °TC	IGNITION UNIT Timing Firing Order	COIL Make	COIL Amperage Draw. Engine Stopped	COIL Amperage Draw. Engine Idling	Ignition Switch Make	SPARK PLUG Make	SPARK PLUG Model	SPARK PLUG Thread	SPARK PLUG Gap	Line Number
1	American-Bantam TS	CP	Ce	FB	Yes	....	No	No	Ce	.....	1½	11¾	1½	7½	6	....	1	V-	.....	¾	Ga	.....	AL	.....	No	10	....	.018	3B	1-5-3-6-2-4	AL	5.0	3.0	Oak	Ch	J-6	14	.025	1
2	Auburn 654	CP	Ce	FB	Yes	....	No	No	Ce	.....	1½	11¾	1½	7½	16	....	1	V-	.....	¾	Ga	.....	AL	.....	No	10	....	.018	3B	1-5-3-6-2-4	AL	5.0	3.0	Oak	Ch	J-6	14	.025	2
3	Auburn 852	CP	Ce	FB	Yes	....	No	No	Ce	.....	1½	11¾	1½	7½	20	....	1	V-	.....	¾	Ga	.....	AL	.....	No	10	....	.018	3B	1-6-2-5-8-3-7-4	AL	5.0	3.0	Oak	Ch	J-6	14	.025	3
4	Auburn SC-852	CP	Ce	FB	Yes	....	No	No	Ce	.....	1½	11¾	1½	7½	20	....	1	V-	.....	¾	Ga	.....	AL	.....	No	11	....	.013	....	1-6-2-5-8-3-7-4	AL	5.0	3.0	Oak	Ch	J-9-B	14	.025	4
5	Buick 36-40	CP	Ce	FB	Har	Yes	No	No	Cel	Har	1 7/16	....	1 7/16	7⅝	13¼	No	1	V-45	42 11/16	21/32	G-D	HI	DR	663-Y	20	24	12	.015	2B	1-6-2-5-8-3-7-4	DR	4.5	2.5	Oak	AC	H-9	18	.024	5
6	Buick 36-60	CP	Ce	FB	Har	Yes	No	No	Cel	Har	1 7/16	....	1 7/16	5¼	17	No	1	V-45	45 11/16	21/32	Gyr	HI	DR	663-Z	20	14	12	.015	10B	1-6-2-5-8-3-7-4	DR	4.5	2.5	Oak	AC	H-9	18	.024	6
7	Buick 36-80	CP	Ce	FB	Har	Yes	No	No	Cel	Har	1 7/16	....	1 7/16	5¼	17	No	1	V-45	45 11/16	21/32	Gyr	HI	DR	663-Z	20	14	12	.015	10B	1-6-2-5-8-3-7-4	DR	4.5	2.5	Oak	AC	H-9	18	.024	7
8	Buick 36-90	CP	Ce	FB	Har	Yes	No	No	Cel	Har	1 7/16	....	1 7/16	5¼	17	No	1	V-45	45 11/16	21/32	Gyr	HI	DR	663-Z	20	14	12	.015	10B	1-6-2-5-8-3-7-4	DR	4.5	2.5	Oak	AC	H-9	18	.024	8
9	Cadillac V8-60	CP	Ce	GB	No	No	Own	Th	Cel	Har	2	7	1¼	2-10¾	25	....	1	V-34	11½C	1 1/32	Gyr	AFB	DR	665-G	20	22	No	.015	5B	1-8-7-3-6-5-4-2	DR	4.4	2.2	DR	AC	K-7	14	.026	9
10	Cadillac V8-65	CP	Ce	GB	No	No	Own	Th	Cel	Har	2	7	1¼	2-10¾	25	....	1	V-34	11½C	1 1/32	Gyr	AFB	DR	665-G	20	22	No	.015	5B	1-8-7-3-6-5-4-2	DR	4.4	2.2	DR	AC	K-7	14	.026	10
11	Cadillac V8-70	CP	Ce	GB	No	No	Own	Th	Cel	Har	2	7	1¼	2-10¾	25	....	1	V-34	11½C	1 1/32	Gyr	AFB	DR	665-G	20	22	No	.015	5B	1-8-7-3-6-5-4-2	DR	4.4	2.2	DR	AC	K-7	14	.026	11
12	Cadillac V8-75	CP	Ce	GB	No	No	Own	Th	Cel	Har	2	7	1¼	2-10¾	25	....	1	V-34	11½C	1 1/32	Gyr	AFB	DR	665-G	20	22	No	.015	5B	1-8-7-3-6-5-4-2	DR	4.4	2.2	DR	AC	K-7	14	.026	12
13	Cadillac V12-85	CP	Ce	Ch	No	No	Own	Th	Cel	Har	1¾	2-4	1¼	2-7⅝	21	....	1	.....	13¾C	.....	.....	AFB	DR	667-C	20	38	No	.021	10B	(d)	DR	4.4	2.2	DR	AC	G-7	18	.026	13
14	Cadillac V16-90	CP	Ce	Ch	No	No	Own	Th	Cel	Har	1¾	2-4	1¼	9⅛	24	....	1	.....	14C	.....	.....	AFB	DR	4118	20	34	No	.016	4B	(e)	DR	4.4	2.2	DR	AC	G-6	18	.026	14
15	Chevrolet Master	CP	Ce	B	Har	No	No	No	Cel	Har	1½	2¾	1¼	6¼	14½	Yes	1	V-32	42⅞	5/8	Var	Own	DR	649-G	No	46	17	.021	5B	1-5-3-6-2-4	DR	4.8	2.5	DR	AC	K-11	14	.040	15
16	Chevrolet Master De Luxe	CP	Ce	B	Har	No	No	No	Cel	Har	1½	2¾	1¼	6¼	14½	Yes	1	V-32	42⅞	5/8	Var	Own	DR	649-G	No	46	17	.021	5B	1-5-3-6-2-4	DR	4.8	2.5	DR	AC	K-11	14	.040	16
17	Chrysler Royal C-16	CP	Ce	FB	Yes	Yes	No	No	Cel	Ja	.....	.....	.....	.....	20	Yes	1	V-	.....	.....	.....	.....	AL	IGS-4010-1	.....	.....	.....	.020	.....	1-5-3-6-2-4	.....	.....	.....	.....	.....	.....	14	.025	17
18	Chrysler Imperial C-14	CP	Ce	FB	Yes	Yes	No	No	Tu	Long	.....	.....	.....	.....	22	....	1	V-	.....	.....	.....	.....	AL	IGT-4001-F1	.....	.....	.....	.018	.....	1-6-2-5-8-3-7-4	.....	.....	.....	.....	.....	.....	14	.025	18
19	Chrysler Custom Imperial C-15	CP	Ce	FB	Yes	Yes	No	No	Tu	Long	.....	.....	.....	.....	21	....	1	V-	.....	.....	.....	.....	AL	IGT-4001-F1	.....	.....	.....	.018	.....	1-6-2-5-8-3-7-4	.....	.....	.....	.....	.....	.....	14	.025	19
20	Chrysler Airflow C-17	CP	Ce	FB	Yes	Yes	No	No	Tu	.....	.....	.....	.....	.....	17	....	1	V-	.....	.....	.....	.....	AL	IGT-4001-J1	.....	.....	.....	.018	.....	1-6-2-5-8-3-7-4	.....	.....	.....	.....	.....	.....	14	.025	20
21	Cord Front Drive 812	CP	Ce	FB	B&B	No	No	No	Cel	Ja	1½	3	2	11	28	No	1	V-	33¾	¾	Ga	SC	AL	IGP-4006	No	20	No	.015	3B	(f)	AL	5.0	3.7	MiF	Ch	J-9-B	14	.025	21
22	De Soto S-3	CP	Ce	FB	Yes	Yes	No	No	Cel	Ja	.....	.....	.....	.....	20	Yes	1	V-	.....	.....	.....	.....	AL	IGS-4010-1	.....	.....	.....	.020	.....	1-5-3-6-2-4	.....	.....	.....	.....	.....	.....	14	.025	22
23	Dodge D-5	CP	Ce	FB	Yes	Yes	No	No	Cel	.....	.....	.....	.....	.....	16	Yes	1	V-	.....	.....	.....	.....	AL	IGS-4002-A1	.....	.....	.....	.020	.....	1-5-3-6-2-4	.....	.....	.....	.....	.....	.....	14	.025	23
24	Duesenberg J	CP	Ce	GS	.....	.....	Pine	....	Cel	Win	1¾	2⅝	1½	10¾	32	....	1	V-	36½	¾	Gr	SC	DR	.....	20	42	No	.018	6A	1-6-2-5-8-3-7-4	.....	.....	.....	DR	Ch	.....	18	.025	24
25	Ford V8-60	CP	Ce	FB	.....	.....	.....	.....	.....	.....	1.50	7.62	1.50	19	15¼	....	.....	V-	45.8	.63	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	14	.025	25
26	Ford V8-85	CP	Ce	FB	.....	.....	.....	.....	.....	.....	1.75	4.75	1.75	17	22	....	.....	V-	51.2	.63	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18	.025	26
27	Graham Crusader 85	CP	Ce	FB	Ful	No	No	No	Cel	Har	1½	3	1½	8	11	Yes	1	V-38	40	21/32	Gr	SC	DR	623-A	.....	.....	10	.018	2B	1-5-3-6-2-4	DR	.....	.....	.....	Cha	.....	18	.025	27
28	Graham Cavalier 95	CP	Ce	FB	Ful	No	No	No	Cel	Har	1½	3	1½	8	15	Yes	1	V-38	43.3	21/32	Gr	SC	DR	623-A	.....	.....	10	.018	TC	1-5-3-6-2-4	DR	.....	.....	.....	Cha	J-9	14	.025	28
29	Graham Supercharger 116	CP	Ce	FB	Ful	No	No	No	Cel	Har	1½	3	1½	8	15	Yes	1	V-38	44.0	21/32	Gr	SC	DR	623-S	.....	.....	10	.018	4A	1-5-3-6-2-4	DR	5	2.5	.....	Cha	J-9	14	.025	29
30	Graham Supercharger 120	CP	Ce	FB	Ful	No	No	No	Cel	Har	1½	3	1½	8	15	Yes	1	V-38	44.0	21/32	Gr	SC	DR	623-S	.....	.....	10	.018	4A	1-5-3-6-2-4	DR	5	2.5	.....	Cha	J-9	14	.025	30
31	Hudson 73	CP	Ce	FB	B&B	Yes	No	No	Cel	McC	1.56	3	1.5	10	20	No	1	V-42	44.37	.781	Gr	Own	AL	IGW-4013-A	No	28	No	.020	BC	1-5-3-6-2-4	AL	4.5	2.5	MiF	Cha	J-8	14	.022	31
32	Hudson 74-5-6-7	CP	Ce	FB	B&B	Yes	No	No	Cel	McC	1.56	3	1.5	10	20	No	1	V-42	44.37	.781	Gr	Own	AL	IGP-4906-A	No	35	No	.020	BC	1-6-2-5-8-3-7-4	AL	4.5	2.5	MiF	Cha	J-8	14	.022	32
33	La Salle 37-50	CP	Ce	GB	No	No	Own	Th	Cel	Har	2	7	1¼	2-10¾	25	....	1	V-34	11½C	1 1/32	Gyr	AFB	DR	665-G	20	22	No	.015	5B	1-8-7-3-6-5-4-2	DR	4.4	2.2	DR	AC	K-7	14	.026	33
34	Lincoln Zephyr	....	Ce	....	Do	....	No	No	Tu	McC	1¾	7½	1¾	7½	27	....	.....	V-28	54.4	.63	.....	.....	.....	.....	No	.....	.....	.015	.....	m	.....	.....	.....	.....	.....	.....	14	.029	34
35	Lincoln V12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	35
36	Nash Lafayette 400-3710	CP	Ce	GS	Yes	No	No	No	Tu	.....	.....	.....	.....	.....	20	Yes	1	V-32	.....	.....	.....	.....	AL	IGW-4010	No	24	No	.022	10Bm	1-5-3-6-2-4	AL	4.0	2.5	.....	AC	G-8	18	.025	36
37	Nash Ambassador 6-3720	CP	Ce	GS	Yes	No	No	No	Tu	.....	.....	.....	.....	.....	17	Yes	1	V-32	.....	.....	.....	.....	AL	IGE-4012-B	No	18	No	.022	15Bm	1-5-3-6-2-4	AL	.....	6.0	.....	AC	K-12	14	.022	37
38	Nash Ambassador 8-3780	CP	Ce	GS	Yes	No	No	No	Tu	.....	.....	.....	.....	.....	18	Yes	1	V-32	.....	.....	.....	.....	AL	IGK-4101	No	30	No	.020	15Bm	1-6-2-5-8-3-7-4	AL	4.0	2.5	.....	AC	K-12	14	.022	38
39	Oldsmobile F-37	CP	Ce	FB	Har	Yes	No	No	Cel	Har	1½	11	1½	8¾	16	Yes	1	V-32	44 11/16	21/32	Var	Own	DR	739-G	No	25	34	.020	TC	1-5-3-6-2-4	DR	4.5	2.0	DR	AC	K-9	14	.040	39
40	Oldsmobile L-37	CP	Ce	FB	Har	Yes	No	No	Cel	Har	1¾	11	1½	8¾	20	Yes	1	V-32	44 11/16	21/32	Var	Own	DR	729-J	No	471/2	33	.015	2B	1-6-2-5-8-3-7-4	DR	4.5	2.0	DR	AC	K-9	14	.040	40
41	Packard Six 115-C	CP	Ce	FB	.....	....	No	No	Cel	McC	1½	3	1½	10	17	....	1	V-42	43	3/4	.....	.....	DR	647-E	No	10	7½	.015	4B	1-5-3-6-2-4	DR	2½	½	.....	CA	Y-4*	10	.029	41
42	Packard 120-C	CP	Ce	FB	.....	....	No	No	Cel	Har	1½	3	1½	10	20	....	1	V-42	43	3/4	.....	.....	AL	IGT-4004	No	10	7½	.015	7B	1-6-2-5-8-3-7-4	AL	2½	½	.....	CA	Y-4*	10	.029	42
43	Packard Super Eight	CP	Ce	FB	.....	....	Yes	Th	Tu	McC	1¾	5⅝	1¾	6½	24	....	1	V-42	47⅝	1	.....	.....	DR	683-L	No	9	5½	.015	6B	1-6-2-5-8-3-7-4	DR	2½	½	.....	CA	Y-4*	10	.029	43
44	Packard Twelve	CP	Ce	FB	.....	....	Yes	Th	Tu	McC	2	11	1½	.....	40	....	1	V-45	49¾	25/32	.....	.....	AL	IGO-4002-A	.....	.....	.....	.020	6B	(b)	2-AL	2½	½	.....	CA	Y-4*	10	.029	44
45	Pierce-Arrow 1701	CP	Ce	....	No	No	Pi	Au	Tu	Long	2¼	3¼	1½	14	25	Yes	2	V-45	52⅝	5/8	Fir	SC	DR	.....	33	16	No	.018	5A	1-6-2-5-8-3-7-4	DR	2	4	DR	Ch	U-6	14	.023	45
46	Pierce-Arrow 1702	CP	Ce	....	No	No	Pi	Au	Tu	Long	2¼	18¾	1½	(g)	38	Yes	2	V-45	57½	5/8	Fir	SC	DR	.....	33	12	No	.018	5B	(h)	DR	2	4	DR	AC	(k)	14	.023	46
47	Pierce-Arrow 1703	CP	Ce	....	No	No	Pi	Au	Tu	Long	2¼	18¾	1½	(g)	38	Yes	2	V-45	57½	5/8	Fir	SC	DR	.....	33	12	No	.018	5B	(h)	DR	2	4	DR	AC	(k)	14	.023	47
48	Plymouth P-3	CP	Ce	FB	Yes	Yes	No	No	Cel	Mc-Ja	.....	.....	.....	.....	15	Yes	1	V-	.....	.....	.....	.....	AL	IGS-4003-B1	.....	.....	.....	.020	.....	1-5-3-6-2-4	.....	.....	.....	.....	.....	.....	14	.025	48
49	Plymouth P-4	CP	Ce	FB	Yes	Yes	No	No	Cel	Mc-Ja	.....	.....	.....	.....	15	Yes	1	V-	.....	.....	.....	.....	AL	IGS-4003-B1	.....	.....	.....	.020	.....	1-5-3-6-2-4	.....	.....	.....	.....	.....	.....	14	.025	49
50	Pontiac De Luxe Six 37-26 CA	CP	Ce	FB	Har	Yes	No	No	Cel	Har	1½	9¼	1¾	9¾	16	Yes	1	V-28	46 1/32	3/4	Own	Own	DR	647-D	20	22	15	.018	4B	1-5-3-6-2-4	DR	.....	.....	DR	AC	K-7	14	.025	50
51	Pontiac De L. Eight 37-28 CA	CP	Ce	FB	Har	Yes	No	No	Cel	Har	1½	9½	1¾	9¾	19	Yes	1	V-28	46 1/32	3/4	Own	Own	DR	663-X	20	22	20	.018	4B	1-6-2-5-8-3-7-4	DR	.....	.....	DR	AC	K-7	14	.025	51
52	Studebaker Dict. & Dict. Pl. 6	CP	Ce	FB	Ful	Y	No	No	Tu	McC	2	5¾	1¼	8½	.....	Y	1	V-38	44⅝	3/4	Var	SC	AL	IGW-4001	No	21	12	.020	2B	1-5-3-6-2-4	AL	4-5	½-1½	AL	Cha	8	18	.025	52
53	Studebaker President	CP	Ce	FB	B&B	Y	No	No	Tu	Long	1¾	3	2½	10¾	.....	Y	1	V-38	49¼	25/32	Var	SC	DR	662-M	No	27	12	.020	TC	1-6-2-5-8-3-7-4	DR	4-5	½-1½	DR	Cha	8	18	.025	53
54	Terraplane 71	CP	Ce	FB	None	No	No	No	Cel	McC	1.62	8.5	1.5	10	12½	No	1	V-42	44.37	.781	Gr	Own	AL	IGW-4012A	No	28	No	.020	BC	1-5-3-6-2-4	AL	4.5	2.5	MiF	Cha	J-8	14	.022	54
55	Terraplane 72	CP	Ce	FB	B&B	Y	No	No	Cel	McC	1.62	8.5	1.5	10	20	No	1	V-42	44.37	.781	Gr	Own	AL	IGW-4012A	No	28	No	.020	BC	1-5-3-6-2-4	AL	4.5	2.5	MiF	Cha	J-8	14	.022	55
56	Willys 37	CP	Ce	FB	No	No	No	No	Cel	Ja	1 1/16	(c)	1½	10¾	11	No	1	V-42	42 11/32	11/16	The	Own	AL	IGS-4007	No	25	23	.018	BC	1-3-4-2	AL	4.0	2.5	HAD	Var	.....	18	.025	56

*—AC Numbers Given
2—Two Used
(a)—One 13 long, one 14 long
A—After Top Dead Center
AL—Auto Lite
AFB—Automotive Fan and Bearing Co.
(b)—1R, 6L, 5R, 2L, 3R, 4L, 6R, 1L, 2R, 5L, 4R, 3L
B—Before Dead Center
B&B—Bishop & Babcock
BC—Bottom Dead Center
Bel—Belden
BM—Before Marks
3BR—Third Brush
(c)—One 5 1/16 Long, One 2 1/16 Long
C—Center to Center
CA—Champion or AC
Ce—Centrifugal
Cel—Cellular
Ch—Chain
Cha—Champion
CP—Circulating Pump
(d)—1, 4, 9, 8, 5, 2, 11, 10, 3, 6, 7, 12
Do—Dole

ABBREVIATIONS:

DR—Delco Remy
(e)—1, 8, 9, 14, 3, 6, 11, 2, 15, 10, 7, 4, 13, 12, 5, 16
(f)—1L, 3L, 4L, 2L, 2R, 1R, 3R, 4R
FB—Fan Belt
Fir—Firestone
Ful—Fulton
(g)—One 10½ Long, One 9½ Long
Ga—Gates
GB—Generator Belt
GD—Goodyear or Dayton
GM—General Motors
Gen—General Cable Co.
Gr—Goodrich
GS—Generator Shaft
Gyr—Goodyear
(h)—1, 4, 9, 8, 5, 2, 11, 10, 3, 6, 7, 12
HAD—H. A. Douglass Co.
Har—Harrison
HI—Hayes Industries
Ja—Jamestown
(k)—U-5 or U-9
(m)—1, 4, 9, 8, 5, 2, 11, 10, 3, 6, 7, 12
McC—McCord
McJa—McCord or Jamestown
Mit—Mitchell Specialty Co.
Oak—Oakes
Pack—Packard
Pi—Pines
s—Inside
SC—Schwitzer Cummins
TC—Top Dead Center
Th—Thermostatic
The—Thermoid
TS—Thermo Syphon
Tu—Tube and Fin
V—Vee Type Belt
Var—Various
Win—Winchester

TIMING GEARS AND VALVE TUNE-UP

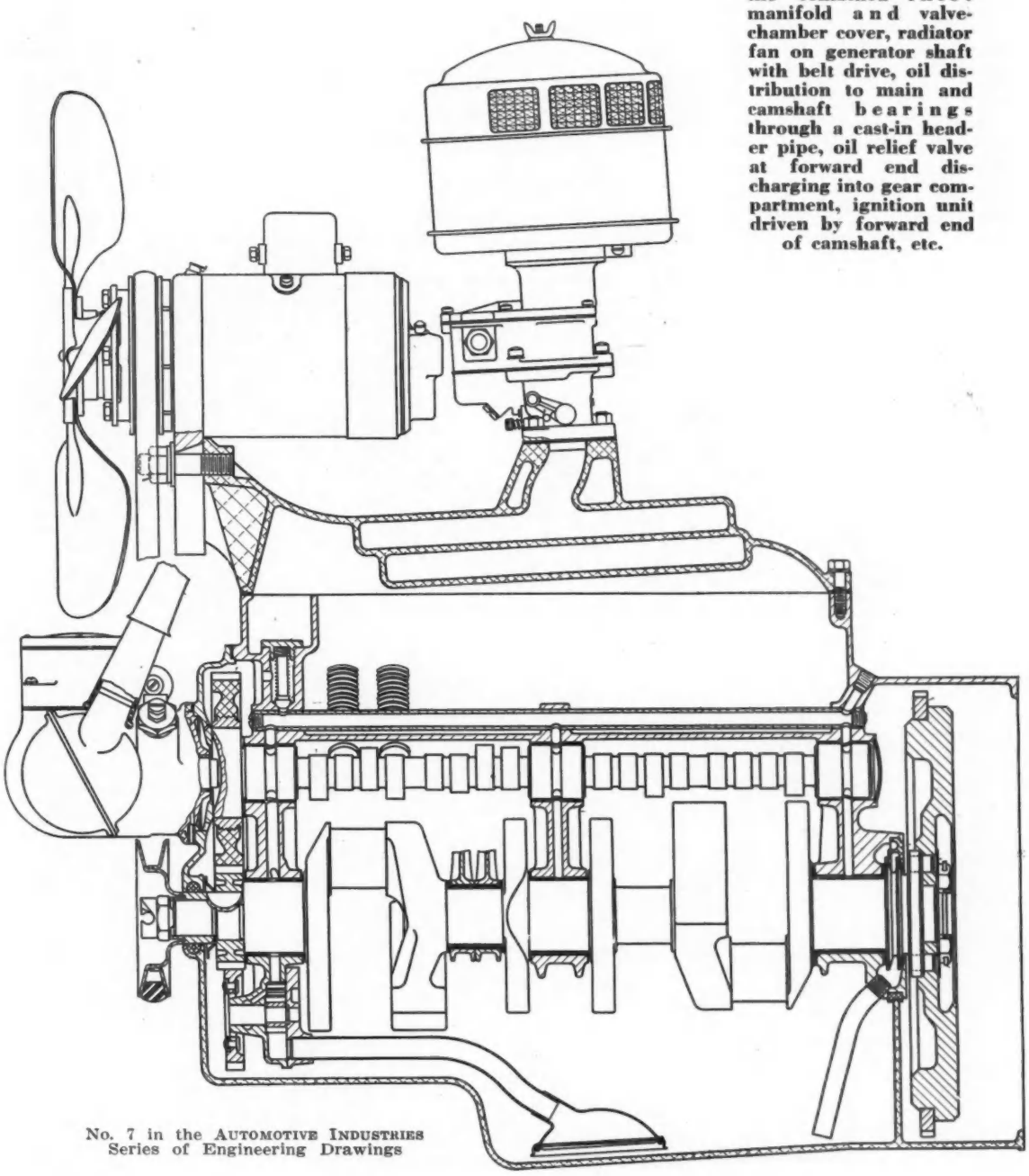
Line Number	CAR MAKE AND MODEL	CRANKSHAFT GEAR		CAMSHAFT GEAR		GENERATOR GEAR		TIMING CHAIN					VALVE TAPPET CLEARANCE				VALVE TIMING				Line Number
													Intake		Exhaust		Intake		Exhaust		
		Make	Material	Make	Material	Make	Material	Make	No. of Links	Width	Pitch	Adjustment	Operating	Valve Timing	Operating	Valve Timing	Opens	Closes	Opens	Closes	
1	American-Bantam																				1
2	Auburn 654	Whit	SS	Whit	1020			Whit	49	1.00	.500	No	.010H	.012H	.010H	.012H	7½B	37½AL	50BL	5A	2
3	Auburn 852	Whit	SS	Whit	1020			Whit	49	1.00	.500	No	.010H	.012H	.010H	.012H	7½B	37½AL	50BL	5A	3
4	Auburn SC-852	Whit	SS	Whit	1020			Whit	58	1¼	.500	No	.010H	.012H	.010H	.012H	7½B	37½AL	50BL	5A	4
5	Buick 37-40	Own	1112	Own	CI	No	No	LB	49	1.00	.500	No	.015	.004	.015	.004	13B	68AL	55BL	22A	5
6	Buick 37-60	Own	1112	Own	CI	No	No	LB	50	1.25	.500	No	.015	.004	.015	.004	14B	71AL	56BL	25A	6
7	Buick 37-80	Own	1112	Own	CI	No	No	LB	50	1.25	.500	No	.015	.004	.015	.004	14B	71AL	56BL	25A	7
8	Buick 37-90	Own	1112	Own	CI	No	No	LB	50	1.25	.500	No	.015	.004	.015	.004	14B	71AL	56BL	25A	8
9	Cadillac V8-60	Own	1120	Own	Cla	No	No	Mor	62	1¼	.375	No	AA-O	AA-O	AA-O	AA-O	TC	42AL	52BL	10A	9
10	Cadillac V8-65	Own	1120	Own	Cla	No	No	Mor	62	1¼	.375	No	AA-O	AA-O	AA-O	AA-O	TC	42AL	52BL	10A	10
11	Cadillac V8-70	Own	1120	Own	Cla	No	No	Mor	62	1¼	.375	No	AA-O	AA-O	AA-O	AA-O	TC	42AL	52BL	10A	11
12	Cadillac V8-75	Own	1120	Own	Cla	No	No	Mor	62	1¼	.375	No	AA-O	AA-O	AA-O	AA-O	TC	42AL	52BL	10A	12
13	Cadillac V12-85	Own	Stl	Own	SS	Own	Stl	Mor	110	1½	.375	AA	AA-O	AA-O	AA-O	AA-O	TC	44AL	39BL	5A	13
14	Cadillac V16-90	Own	Stl	Own	SS	Own	Stl	Mor	110	1½	.375	AA	AA-O	AA-O	AA-O	AA-O	TC	40AL	39BL	5A	14
15	Chevrolet Master	Own	Stl	Var	BF	No	No	No	No	No	No	No	.006H	.006H	.013H	.013H	9B	29AL	52BL	1B	15
16	Chevrolet Master De Luxe	Own	Stl	Var	BF	No	No	No	No	No	No	No	.006H	.006H	.013H	.013H	9B	29AL	52BL	1B	16
17	Chrysler Royal C-16					No	No			1.00	.500	No	.006H	.014	.010H	.014	TC	50AL	48BL	2A	17
18	Chrysler Imperial C-14					No	No			1¼	.500	No	.006H	.011	.010H	.014	2B	44AL	46BL	4A	18
19	Chrysler Custom Imperial C-15					No	No			1¼	.500	No	.006H	.011	.010H	.014	2B	44AL	46BL	4A	19
20	Chrysler Airflow C-17					No	No			1¼	.500	No	.006H	.011	.010H	.014	2B	44AL	46BL	4A	20
21	Cord Front Drive 812	Whit	MS	Whit	SS	No	No	Whit	58	1¼	.500	No	.009	.016	.009	.016	7½B	37½AL	50BL	5A	21
22	De Soto S-3					No	No			1.00	.500	No	.006H	.014	.010H	.014	TC	50AL	48BL	2A	22
23	Dodge D-5					No	No			1.00	.500	No	.006H	.011	.008H	.014	6A	46AL	42BL	8A	23
24	Duesenberg 8	LB	Stl	LB	Stl	LB	Stl	LB	126	2.00	.375	Au	.0153	.025	.015C	.025	6B	40A	40B	14A	24
25	Ford V8-60																9½B	54½AL	57½BL	6½A	25
26	Ford V8-85																9½B	54½AL	57½BL	6½A	26
27	Graham Crusader 85							LB	46	1.00	.500	No	.010	.012	.010	.012	4½B	47½AL	47½BL	4½A	27
28	Graham Cavalier 95							LB	46	1.00	.500	No	.010	.012	.010	.012	2A	54AL	41BL	11A	28
29	Graham Supercharger 116							LB	46	1.00	.500	No	.010	.012	.010	.012	4½B	47½AL	47½BL	4½A	29
30	Graham Supercharger 120							LB	46	1.00	.500	No	.010	.012	.010	.012	4½B	47½AL	47½BL	4½A	30
31	Hudson 73	Own	CI	Con	Bak	No	No	No	No	No	No	No	.008		.010		10° 40'B	60A	50B	18° 44'A	31
32	Hudson 74-5-6-7	Own	CI	Con	Bak	No	No	No	No	No	No	No	.008		.010		10° 40'B	60A	50B	18° 44'A	32
33	La Salle 37-50	Own	1120	Own	Cla	No	No	Mor	62	1¼	⅜	No	AA-O	AA-O	AA-O	AA-O	TC	42AL	52BL	10A	33
34	Lincoln Zephyr																				34
35	Lincoln V-12												AA	AA	AA	AA					35
36	Nash Lafayette 400-3710		Stl	Own	CI	No	No		80	[illegible]		No	.015	.015	.015	.015					36
37	Nash Ambassador 6-3720		Stl	Own	CI	No	No		60	[illegible]		No	.008H	.008H	.015H	.015H					37
38	Nash Ambassador 8-3780		Stl	Own	CI	No	No		62	[illegible]		No	.008H	.008H	.015H	.015H					38
39	Oldsmobile F-37	Whit	Stl	Whit	CI	No	No	Whit	47	1.00	500	No	.008		.011		5B	45AL	45BL	5A	39
40	Oldsmobile L-37	LB	Stl	LB	CI	No	No	LB	47	1.00	500	No	.008		.011		TC	35AL	45BL	10A	40
41	Packard Six		St		CI	No	No	Mor	58	1¼	.375	No	.007	.007	.010	.010	5B	39AL	5A	45BL	41
42	Packard 120-C		St		CI	No	No	Mor	58	1¼	.375	No	.007	.007	.010	.010	5B	39AL	5A	45BL	42
43	Packard Super Eight		St		St	No	No	Mor	70	1½	.375	No	.004	.004	.006	.006	30B	65AL	30A	65BL	43
44	Packard Twelve		St		St	No	No	Mor	56	1¾	.500	No	AA	AA	AA	AA	TC	45AL	10A	35BL	44
45	Pierce-Arrow 1701	Whit	MS	Whit	CI	No	No	Whit	50	1½	.500	No	AA	.010	AA	.010	5A	45AL	40BL	12A	45
46	Pierce-Arrow 1702	Whit	MS	Whit	CI	No	No	Whit	53	1½	.500	No	AA	.004	AA	.006	19B	69AL	56BL	28A	46
47	Pierce-Arrow 1703	Whit	MS	Whit	CI	No	No	Whit	53	1½	.500	No	AA	.004	AA	.006	19B	69AL	56BL	28A	47
48	Plymouth P-3		St			No	No			1.00	.500	No	.006H	.011	.008H	.012	6A	46AL	42BL	8A	48
49	Plymouth P-4		St			No	No			1.00	.500	No	.006H	.011	.008-H	.012	6A	46AL	42BL	8A	49
50	Pontiac De Luxe Six 37-26 CA	Own	St	Own	CI	No	No	Mor	56	[illegible]	.375	No	.012H	.015	.012H	.015	5B	39AL	45BL	5A	50
51	Pontiac De Luxe Eight 37-28 CA	Own	St	Own	CI	No	No	Mor	56	1	.375	No	.012H	.015	.012H	.015	5B	39AL	45BL	5A	51
52	Studebaker Dict. & Dict. Pl. 6	Own	CI	Con	Cel	No	No	No	No	No	No	No	.016C	.020	.016C	.020	15B	49AL	54BL	10A	52
53	Studebaker President	Own	CI	Con	Cel	No	No	No	No	No	No	No	.016C	.020	.016C	.020	15B	49AL	54BL	10A	53
54	Terraplane 71	Own	CI	Con	Bak	No	No	No	No	No	No	No	.008		.010		10° 40'B	60A	50B	18° 44'A	54
55	Terraplane 72	Own	CI	Con	Bak	No	No	No	No	No	No	No	.008		.010		10° 40'B	60A	50B	18° 44'A	55
56	Willys 37	LB	1020	LB	SSt	No	No	LB	47	1¼	.500	No	.004	.010	.006	.010	TC	45AL	40BL	45A	56

ABBREVIATIONS

A—After Top Dead Center
Au—Automatic
AA—Automatic Adjustment
AL—After Lower Dead Center
B—Before Top Dead Center
Bak—Bakelite
BF—Bakelite and fabric composition
BL—Before Lower Dead Center
C—Cold
Cel—Celeron
CI—Cast Iron
Con—Continental Diamond Fibre Co.
LB—Link Belt
Mor—Morse
MS—Manganese Steel
SS—Semi-Steel
St—Steel
TC—Top Dead Center
Var—Various

Ford 60 hp. V-8 Engine

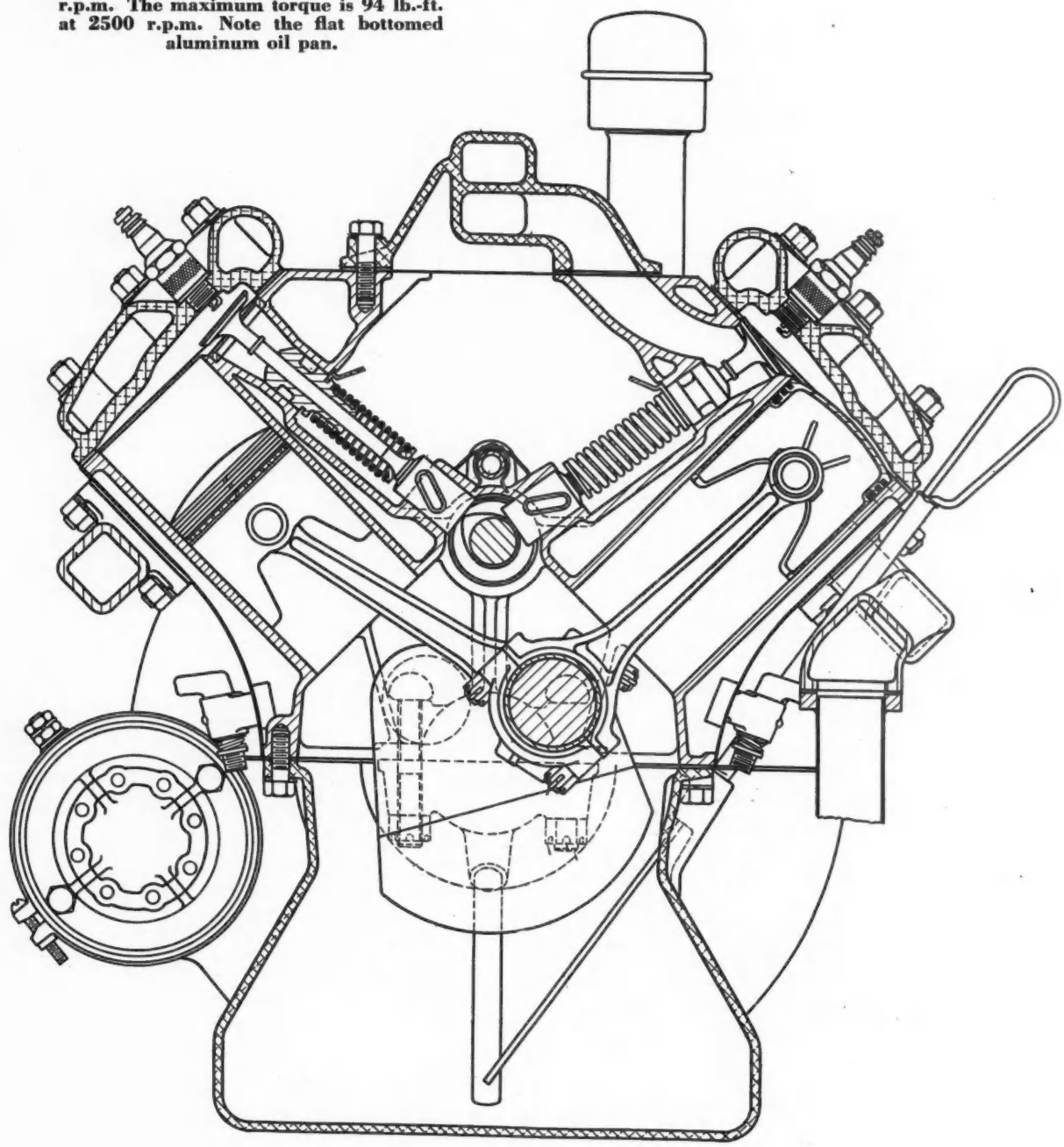
Longitudinal section, showing the three-bearing crankshaft with heavy counterweights, the combined inlet manifold and valve-chamber cover, radiator fan on generator shaft with belt drive, oil distribution to main and camshaft bearings through a cast-in header pipe, oil relief valve at forward end discharging into gear compartment, ignition unit driven by forward end of camshaft, etc.



No. 7 in the AUTOMOTIVE INDUSTRIES Series of Engineering Drawings

Ford 60 hp. V-8 Engine

Transverse section. This engine has a bore of 2.6 and a stroke of 3.2 in., making its displacement 136 cu. in. It has a compression ratio of 6.6 and a compression pressure of 150 lb. per sq. in. at 2800 r.p.m. The rating is 60 hp. at 4200 r.p.m. The maximum torque is 94 lb.-ft. at 2500 r.p.m. Note the flat bottomed aluminum oil pan.



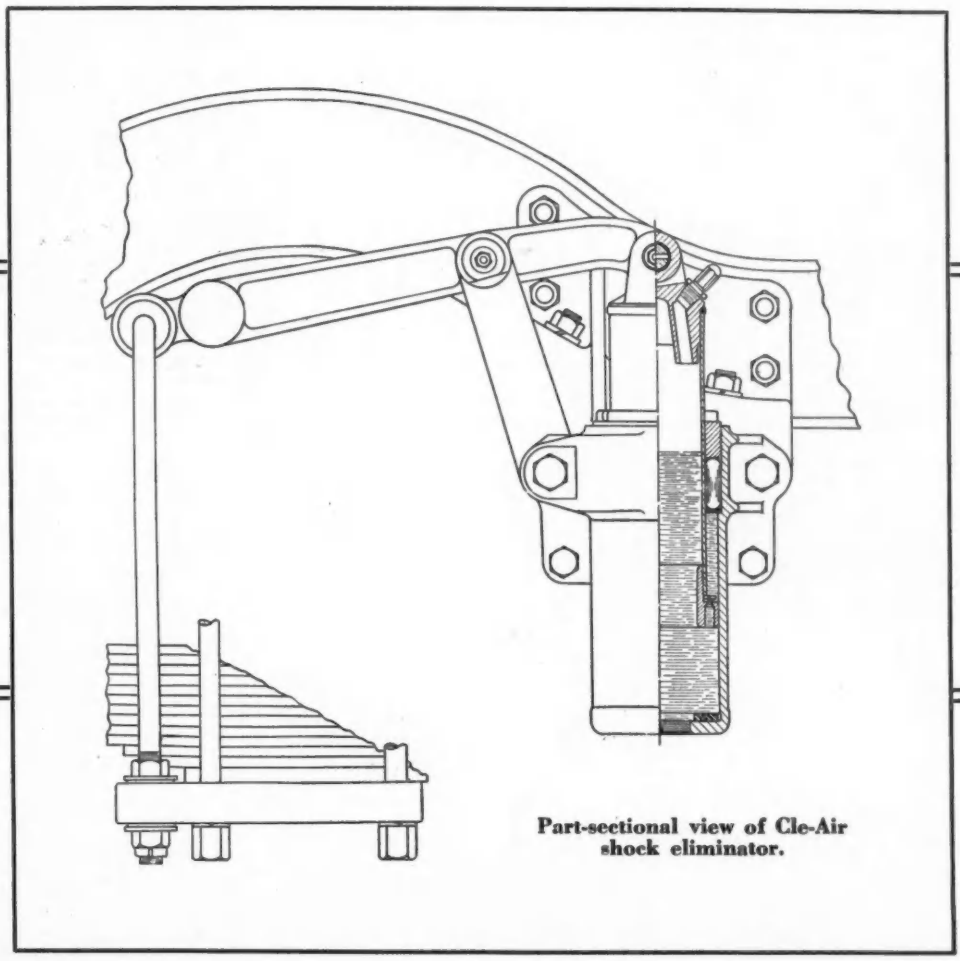
Combined Air Cushion and Shock Absorber

A COMBINED air cushion and shock absorber (or spring damper) for commercial vehicles, known as the "Cle-Air," has been placed on the market by the Cleveland Pneumatic Tool Co. It is specially designed for use with the rear springs of trucks, tractors and buses. As an air cushion it works in conjunction with the regular (steel) chassis springs, relieving the latter of a part of their load, while as a damper it controls the rebound. By means of a suitable bracket, the device is secured to the chassis frame, in such a position that the rod connecting its arm to the axle is substantially vertical. This rod has a travel range of about 10 in., which is just twice the piston stroke. When the device is being mounted it is so set that with a normal load upon it the piston is still about ½ in. from mid-stroke. A load of anywhere between 500 and 1000 lb. may be carried on the "Cle-Air," depending on the pressure to which it is inflated. Damping is effected by forcing the fluid through an orifice.

It is well known that with an air cushion the rate varies, increasing with the deflection, in contrast to a steel spring, in which the rate is constant throughout the range. It is therefore claimed for the air cushion that it can be made very soft around the neutral point, the point of compression under static load, and still take care of severe road shocks.

Referring to the sectional view reproduced herewith, it will be seen that the device consists of a cylinder containing a piston. The latter comprises a length of steel tubing which is welded to a yoke at its upper, and screwed to a piston head at its lower end. The piston head, which is a good sliding fit in the cylinder, is of considerably larger diameter than the tubular part of the piston, so that an annular space is formed between the latter and the cylinder bore. This space communicates with the space in the lower part of the cylinder and in the hollow piston through a recoil valve. When the spring compresses, this valve opens wide automatically, allowing free flow of the fluid from the cylinder into the annular space, but on the recoil it closes and then forces the fluid to pass through an orifice in the valve.

A special packing ring, of a material used for aircraft shock absorbers, is inserted between the cylinder and the tubular part of the piston, being held between a disk resting against a shoulder in the cylinder bore and a bearing nut. At the bottom of the cylinder there is a bumper ring of oil-resisting synthetic rubber. Air pressure is pumped up in the cylinder through an air valve screwed into the yoke or piston cap.



Part-sectional view of Cle-Air shock eliminator.

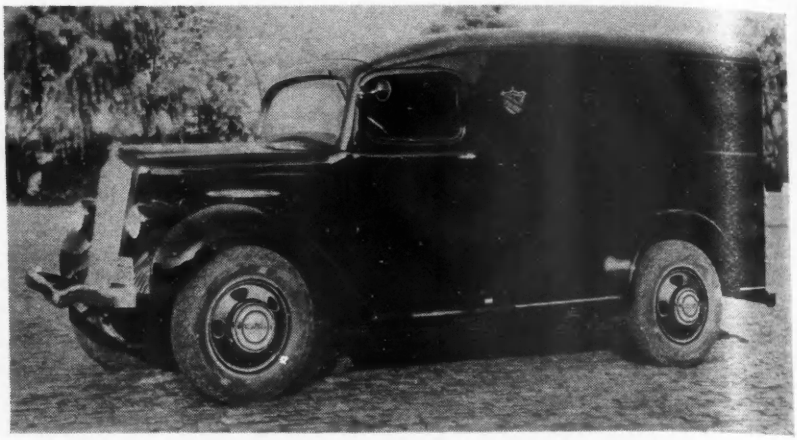
$33.20 Average Weekly Automotive Pay in Nov.

Reports made today to the U. S. Bureau of Labor Statistics show that automobile and body plants employed 350,000 persons last month, a figure 26,000 higher than the recent highs of December, 1935, and May, 1936. The totals set a new post-depression peak. Current reports from the factories indicate even greater employment for December.

Comparison with previous years indicates that 120,000 of the automobile factory workers now on the rolls are at work because of the advance from January to November of the introduction date for new models.

With the same force stimulating production and employment in automobile parts plants, steel mills, tire factories, textile mills and many others which supply the auto plants, it is estimated that at least 175,000 workers owe fall and winter employment to the stabilization policies of the automobile manufacturing industry.

Weekly payrolls in November averaged $11,650,000 for the 350,000 persons employed, an average of $33.20 per employe, for an average work week of approximately 40 hours. With the cost of living in automobile centers still 18 per cent below 1929 levels, current weekly earnings are equivalent to over $40 in 1929 purchasing power, an all-time high. The total payroll represents an increase of 170 per cent above November, 1934, before the early fall model introduction program went into effect, and 20 per cent above November, 1935.



White Model 700 truck equipped with panel body

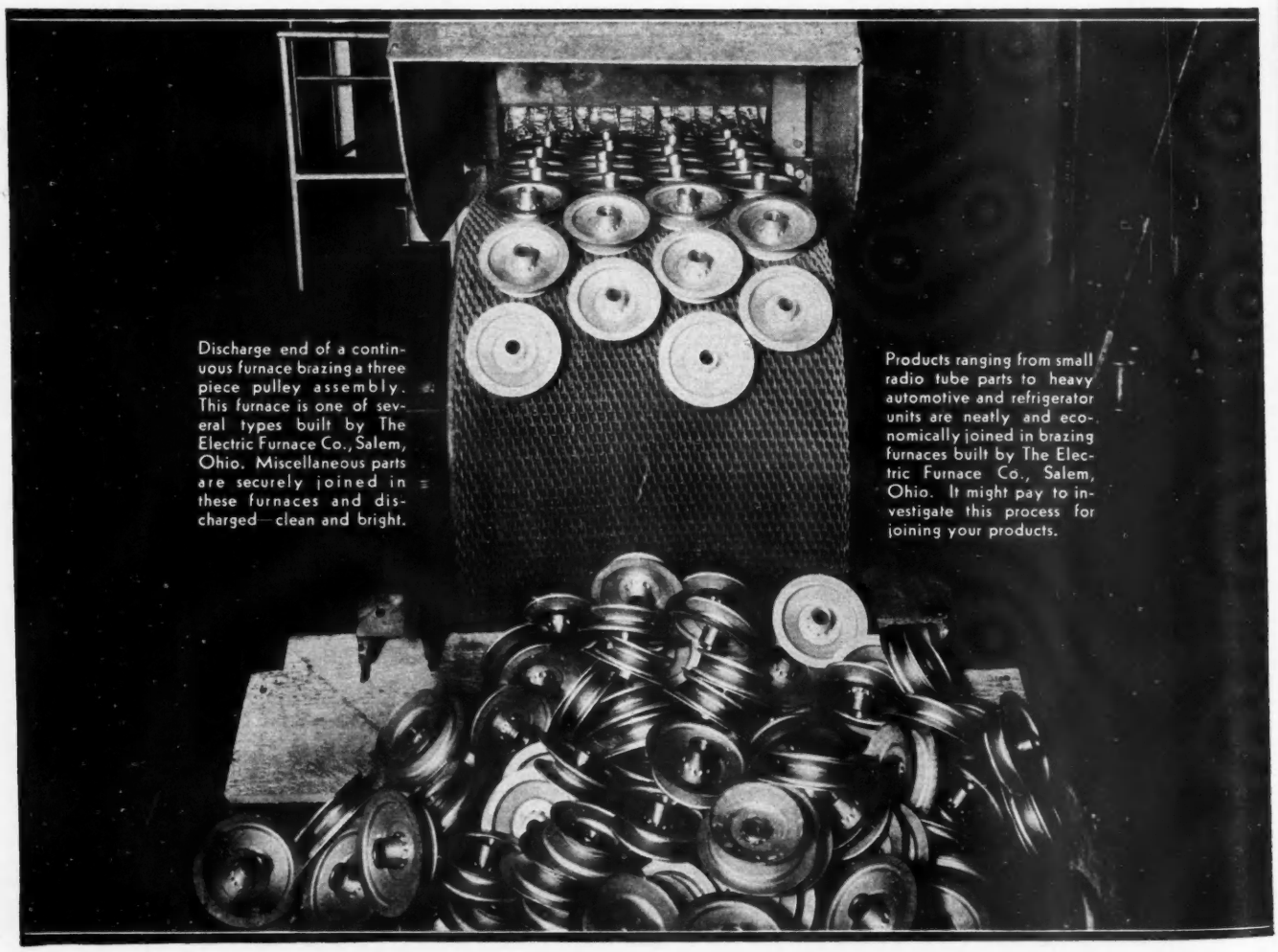
Lower Priced Whites

(*Continued from page 5*)

proper spark advance for every load and speed condition. An inlet manifold of the down draft type further enhances fuel economy by means of a hot spot, automatically controlled, which maintains the mixture in the manifold in a vaporized state.

Evidence of the strength built into the new line is found in the frame which is almost 8 in. in depth with a 3 in. flange. A new design rear axle, with a straddle mounted pinion and chrome-nickel alloy gears, is basically similar to the White full floating axles which have done heavy-duty service in larger capacity trucks.

Styled by Count Alexis de Sakhnoffsky, the new streamlined Model 700 will offer a choice of five different wheelbases, ranging from 136 in. to 196


Discharge end of a continuous furnace brazing a three piece pulley assembly. This furnace is one of several types built by The Electric Furnace Co., Salem, Ohio. Miscellaneous parts are securely joined in these furnaces and discharged—clean and bright.
Products ranging from small radio tube parts to heavy automotive and refrigerator units are neatly and economically joined in brazing furnaces built by The Electric Furnace Co., Salem, Ohio. It might pay to investigate this process for joining your products.

in. The 700K tractor will be furnished in two wheelbases, 136 in. and 148 in. Safety features outstanding on the new jobs will be four-wheel hydraulic brakes having 270 sq. in. of lining area, an adequate motor of 70 hp. developing 165 lb. ft. torque, proper chassis weight to incorporate ruggedness of design, automatic air-ventilated cabs, thickly-insulated floor boards permitting a clean, fume-proof cab the year around, and a twin lever steering gear which increases maneuverability and parking ease.

Brockway Truck Corp. Asks Reorganization Under 77B

Proceedings for the reorganization of Brockway Motor Truck Corp. under the provisions of Section 77B of the National Bankruptcy Act have been instituted by the filing of a petition by that corporation in the United States District Court for the Northern District of New York. The Court approved the petition Dec. 28 and continued the corporation in possession of its properties, pending a hearing of creditors and stockholders to be held at a later date. A plan of reorganization is being developed which is expected to be filed in the near future.

Prior to Sept. 1, 1932, Brockway Motor Truck Corp. manufactured at its plant at Cortland, N. Y., the line of trucks known as "Brockway." On that date substantially all of its assets employed in the manufacture and sale of its products were either sold or leased to Brockway Motor Co., Inc., a new company organized to acquire such assets and to carry on the business formerly conducted by Brockway Motor Truck Corp. Since that time the new company has exclusively conducted the "Brockway" operations, all of its capital stock being held by voting trustees for the benefit of Brockway Motor Truck Corp.

In connection with the filing of the petition by Brockway Motor Truck Corp. George S. Piroumoff, president of Brockway Motor Co., Inc., stated that his company was in a strong financial condition, was not a party to the reorganization proceedings, and that therefore its operations should not in any way be affected.

Sitdown Again Stops French Car Factory

Despite government assurance that stay-in strikes would not be tolerated, strikers are in possession of the Panhard & Levassor automobile factory and the Fulmen storage battery works. The Panhard strike arose from a decision of the management to reduce the number of workers and to limit the hours, following internal reorganization and reduced demand for cars. The Fulmen case appears to be a "sympathy" strike in favor of the hands employed at another factory.

In both cases government officials are seeking to arbitrate between workers and factory management.

Passenger Car and Truck Production—U. S. and Canada

	November, 1936	October, 1936	November, 1935	First Eleven Months, 1936	First Eleven Months, 1935
Passenger Cars—U. S. and Canada:					
Domestic Market—U. S.	315,523	173,955	313,513	3,059,487	2,719,781
Foreign Market—U. S.	25,933	16,733	23,401	190,557	189,441
Canada	10,086	4,592	10,916	114,766	124,896
Total	351,542	195,280	347,830	3,364,810	3,034,118
Trucks—U. S. and Canada:					
Domestic Market—U. S.	41,938	25,706	48,564	589,911	521,331
Foreign Market—U. S.	11,496	8,234	9,581	115,859	111,853
Canada	726	769	2,575	27,145	34,192
Total	54,160	34,709	60,720	732,915	667,376
Total—Domestic Market—U. S.	357,461	199,661	362,077	3,649,398	3,241,112
Total—Foreign Market—U. S.	37,429	24,967	32,982	306,416	301,294
Total—Canada	10,812	5,361	13,491	141,911	159,088
Total—Cars and Trucks—U. S. and Canada	405,702	229,989	408,550	4,097,725	3,701,494

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Your present equipment may be used. Saves time on processing. This bonding process has proven effective under many commercial tests and will give a satisfactory coating in 30 seconds. • It permits a saving on equipment space. • Saves on fuel and heating of tanks, requiring a solution of only 140 to 160 degrees. • Sludge practically eliminated. • Has passed salt spray and humidity tests. • Gives controlled etching—light or heavy. • Has been officially approved by several of Detroit's largest industrial plants.

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Chevrolet '37 Trucks

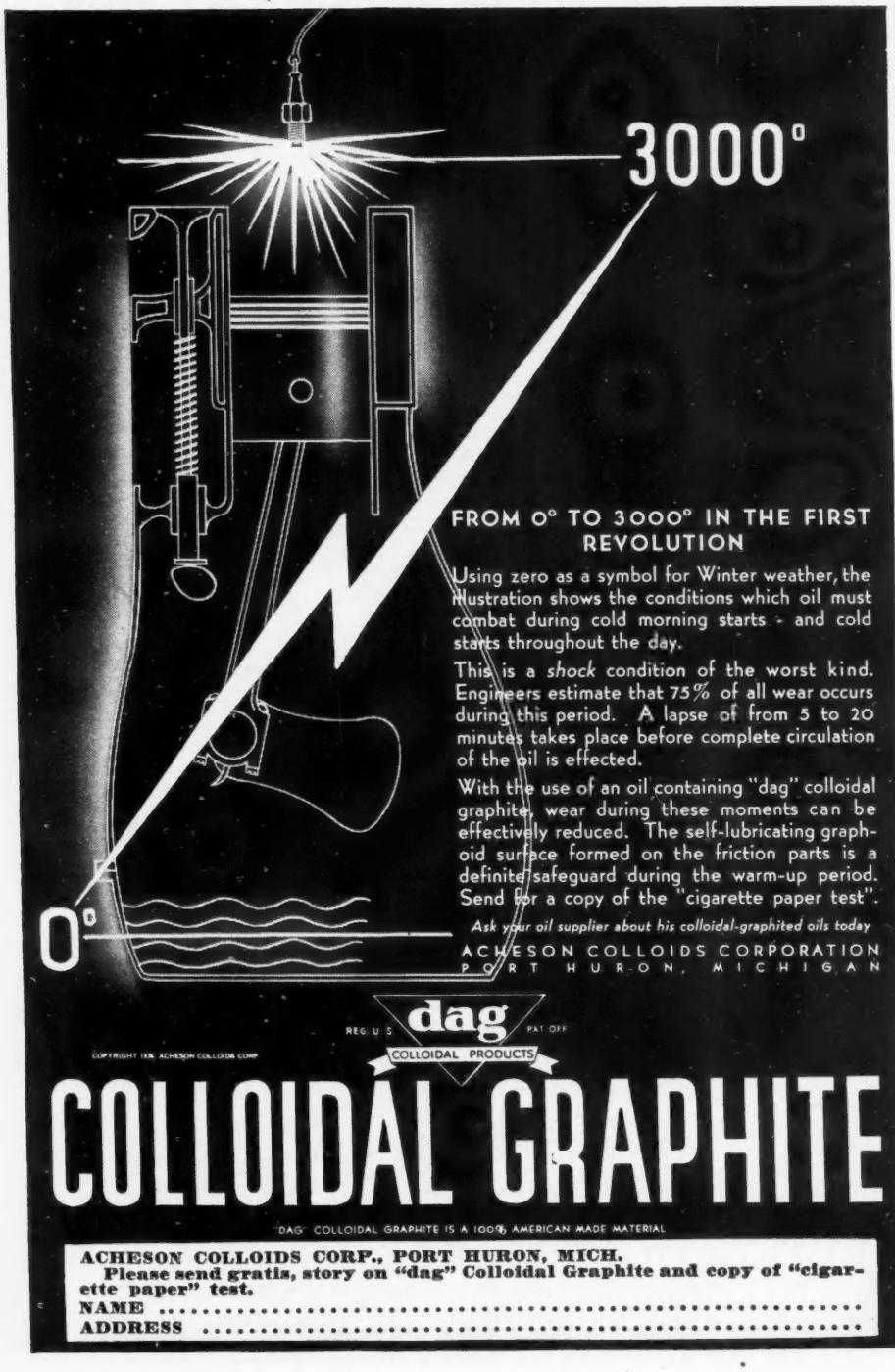
(*Continued from page 5*)

and stronger, being of dome-head, slipper-type skirt construction, with X-rib reinforcement. The crankshaft and camshaft have each four bearings.

The intake manifold has been redesigned to effect better heat control. The chromium bars of the radiator grille are spaced farther apart, thus admitting more air to the core. At the same time, the fan has been relocated to permit the blades to extend higher. A cooling system thermostat has been added to permit greater speed of warming in cold weather.

On both the commercial car and the 1½-ton truck models, the cab and the panel bodies are of all-steel construction, including seamless one-piece tops. Cabs and bodies have improved streamlining as well as some of the distinctive features found in the Chevrolet 1937 passenger models.

The wheelbase of the commercial car remains 112 in. but the forward position of the engine gives almost 12 in. more length to the load floor, while the increased rear tread makes possible an increase of 2⅞ in. in load width. The new models have stronger chassis frames of improved design. Springing has also been changed. The Chevrolet design of hydraulic brakes has been retained, but the piping layout improved by rearranging so as to prevent air pockets and bends. Fuel supply in the trucks is from an 18-gal. tank equipped with a special vent which exhausts fumes outside the cab and body. In the commercial body types, without cabs, a 16-gal. tank is mounted at the right side of the chassis between the second and third cross members.


3000°
0°
FROM 0° TO 3000° IN THE FIRST REVOLUTION
Using zero as a symbol for Winter weather, the illustration shows the conditions which oil must combat during cold morning starts - and cold starts throughout the day.
This is a *shock* condition of the worst kind. Engineers estimate that 75% of all wear occurs during this period. A lapse of from 5 to 20 minutes takes place before complete circulation of the oil is effected.
With the use of an oil containing "dag" colloidal graphite, wear during these moments can be effectively reduced. The self-lubricating graphoid surface formed on the friction parts is a definite safeguard during the warm-up period. Send for a copy of the "cigarette paper test".
Ask your oil supplier about his colloidal-graphited oils today
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Please send gratis, story on "dag" Colloidal Graphite and copy of "cigarette paper" test.
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Arc Welding Foundation Honors James F. Lincoln

Desiring to stimulate scientific development in the arc welding field and to honor the pioneer work of its president in promoting arc welding and developing arc welding equipment and electrodes, the Lincoln Electric Co. has announced plans to establish a fund and foundation to encourage study and research for the benefit of the industry.

The fund will be called "The James F. Lincoln Arc Welding Foundation." Principal direction of the foundation's work will be given by Dr. E. E. Dreese, chairman of the department of electrical engineering of Ohio State University. Other trustees who will serve with Dr. Dreese are: W. B. Stuart, Cleveland attorney, and H. R. Harris, vice-president of the Central United Bank of Cleveland. Dr. Dreese was appointed professor of electrical engineering at Ohio State University after receiving his doctorate from the University of Michigan in 1929. He is the author of numerous papers presented before the American Institute of Electrical Engineers.

Goodrich Makes Belt for Track-Laying Tractors

Perfection of a solid rubber endless traction belt for the track-laying type of farm tractor, is announced by the B. F. Goodrich Co., of Akron. "The development of the rubber track, making available a more versatile heavy-duty tractor, capable of operation over soft terrain, and mobility on the highways without damage to the pavement, should aid in increasing the number of track-laying tractors sold by the industry," states J. D. Tew, Goodrich president. "Production of this type of tractor represented $37,000,000 of the $150,000,000 volume of the tractor industry in 1935."

18,000 U. S. Motorists Visited Mexico This Year

Tourist automobiles entering Mexico from the United States numbered 18,000 this year up to Nov. 1 as compared with 14,500 in the same period of 1935, reports the Mexican Automobile Association. American cars crossing the border in November totaled 1827.

The federal government points to increased American motor tourist traffic as demonstrating the efficacy of its good roads program. Several million dollars are to be invested in furthering that program in 1937.

Delivered Prices Set

(*Continued from page 7*)

Packard One-Twenty	At Detroit Del'd	F.O.B.	Differ'l Per Cent
138 inch wheelbase			
Tour. sedan, 7-pass...	1,835	1,690	+ 8.6
Tour. limousine	1,985	1,840	+ 8.0
One Twenty Deluxe			
Tour. sedan	1,400	1,270	+10.1
Tour. coupe	1,350	1,220	+10.8
Club sedan	1,390	1,260	+10.2
Super Eight			
1500			
Sedan	2,480	2,335	+ 6.2
1501			
Tour. sedan	2,685	2,535	+ 6.0
Formal sedan	3,400	3,235	+ 5.2
Club sedan	2,680	2,530	+ 6.0
Coupe	2,660	2,510	+ 6.0
Coupe, rumble seat...	2,565	2,420	+ 6.0
Conv. coupe	2,830	2,680	+ 5.6
Victoria	3,310	3,150	+ 5.1
1502			
Conv. sedan	3,515	3,350	+ 5.0
Tour. sedan, 7-pass...	2,860	2,705	+ 5.9
Tour. limousine	2,995	2,840	+ 5.5
Business sedan	2,730	2,580	+ 5.9
Business limousine ..	2,870	2,715	+ 5.9
Twelve			
1506			
Touring sedan	3,670	3,490	+ 5.1
1507			
Touring sedan	3,740	3,560	+ 5.1
Formal sedan	4,455	4,260	+ 4.6
Club sedan	3,845	3,660	+ 5.1
Coupe, 5-pass.	3,770	3,590	+ 5.1
*Coupe, 2-4-pass.	...	3,420	..
*Conv. coupe 2-4-pass.	...	3,450	..
*Victoria	...	4,490	..
1508			
*Conv. sedan	...	4,650	..
Tour. sedan	4,070	3,885	+ 4.9
Tour. limousine	4,275	4,085	+ 4.8

*These types not available with 5 wheel equipment.

CHRYSLER

Delivered Prices at Detroit

Includes Federal taxes, bumpers, spare tire and tube and expense incident to preparing car for shipment.

	At Detroit Del'd	F.O.B.	Differ'l Per Cent
Royal Six			
Business coupe	$810	$715	+13.2
Coupe, rumble seat...	860	765	+12.3
Sedan, 2-door	870	775	+12.3
Tour. sedan, 2-door..	880	785	+12.1
Sedan, 4-door	910	815	+11.8
Tour. sedan, 4-door..	920	825	+11.6
Sedan, 7-pass.	1,140	1,045	+ 9.1
Sedan limousine	1,240	1,145	+ 8.5
Convertible coupe	1,005	...	...
Convertible sedan ...	1,340	...	...
Imperial Eight			
Business coupe	1,030	925	+11.5
Coupe, rumble seat...	1,070	965	+11.0
Sedan, trunk, 2-door.	1,070	965	+11.0
Tour. sedan, 4-door..	1,100	995	+10.8
Convertible coupe	1,170	1,065	+10.0
Convertible sedan	1,500	1,395	+ 7.8
Custom Imperial Eight			
Sedan, 7-pass.	2,060	1,895	+ 8.8
Sedan limousine	2,160	1,995	+ 8.2
Airflow			
Sedan	1,610	1,475	+ 9.2
Coupe	1,610	1,475	+ 9.2

Diamond T Announces New All-Steel Pick-up Body

A new all-steel pick-up body for the successful Diamond T three-quarter ton chassis, presented a few weeks ago, is now announced by the Diamond T Motor Car Co. of Chicago.

The new body is built throughout of 13-gage, blue annealed steel. The sides extend to form 5-in. flares with rolled edges at the top. These sides are single sheets of steel. The floor is a separate sheet of steel, carried on four heavy steel cross members, and is joined to the side sheets by welding. This construction permits an inside width of 46 in. for the entire length of the body with a smooth loading space and no wheelhousings.

The sides rise 14 in. from the floor, exclusive of the flares, which produce a total height of 17 in. On each side are three stake pockets, extending down through the flares. The tailgate is 14 in. high and framed in angles for stiffness. Short chains hold the tailgate in horizontal position. The floor of the body is 32 in. from the ground.

Elcar Coach Company Sold to G. J. Wilds

Milo E. Miller, president of the Elcar Coach Co., Elkhart, Ind., has announced that the company has been sold to G. J. Wilds of Chicago, and that Mr. Wilds has assumed active direction. Mr. Miller will continue his connection with the firm as field sales representative.

Shuler Axle's Detroit Office

The Shuler Axle Co., Louisville, Ky., has opened an office in Detroit. It is located in Room 7151 of the General Motors Building.

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FOR PRECISION ADJUSTMENT of cutting tools, just P-E-E-L the paper-thin brass laminations....002" or more at a time! No filing . . . no machining.
Setups can be made up from standard tool-holders without costly machining and fitting. A real money-saver. Tool-holders remain standard for retooling. Write for a sample of LAMINUM.
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The Use of Silver Solders

A PAPER bearing the above title was presented at the Cleveland meeting (Oct. 21) of the American Welding Society by R. H. Leach, manager of Handy & Harman, Bridgeport, Conn. Mr. Leach pointed out that silver soldering is no different in principle from soldering with plumber's or tinsmith's solder, which is familiar to every one. But whereas ordinary solder, which is made of tin and lead, melts at about 300 deg. F., silver solder, which is made of silver and copper, with usually some zinc, melts only at much higher temperatures—1200-1600 deg. F.

The advantages of silver solder over other types are greater strength, resistance to vibration and shock, resistance to corrosion, and ease of fabrication. Practically all metals that can be heated without danger to 1200 deg. F., can be silver-soldered.

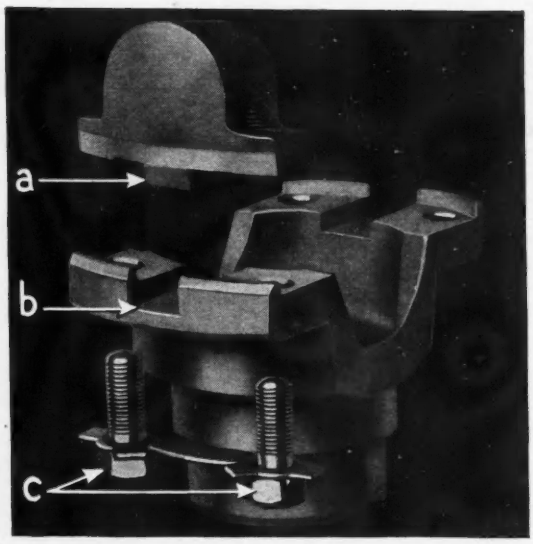
The strongest silver-soldered joints are made with the remarkably small gap of 0.0015 in. between the parts to be joined. Being so thin, the joint has a neat appearance. In many cases the silver-soldered joint is invisible to the naked eye. Mr. Leach cited a test of a silver-soldered assemblage of 1-in. brass pipe which withstood a water pressure of 4300 lb. per sq. in. without failure. Under direct loading one of the brass fittings fractured but the silver-soldered joints remained sound.

In addition to its strength at high temperatures, which makes silver soldering suitable for joining electrical parts or piping that must withstand temperatures up to 850 deg. F., the joint has good corrosion resistance. Silver soldering is used especially in chemical equipment in which joints are exposed to severe corrosive action by acids or other reagents.

Recent developments in silver soldering have made it extremely easy to produce excellent joints. A method that is often used for pipes, requires simply a torch and a ring of silver solder of the same diameter as the pipe. The torch is fed with illuminating gas and air or oxygen. The ring of silver solder is slipped over the pipe to be soldered. The fitting is then slipped over the pipe and the ring. The joint is heated uniformly with the torch until silver solder is seen oozing out at the edge of the joint. Nothing more need be done.

Other developments include dip brazing, in which the joint to be made is dipped in a bath of molten silver solder; and resistance brazing, in which inserts are used as described above, but the heat is supplied electrically rather than by a torch. These and other new developments are rapidly extending the fields of application of silver soldering.

MECHANICS



Integral Keys Transmit Torque

Heavy keys (a) on the bearing and corresponding keyways (b) in the flanges, accurately machined out of solid metal, transmit all of the torque in Mechanics Roller Bearing Universal Joints. Two cap screws (c) hold each bearing securely in place against the flange . . . this is their only function . . . they have a high factor of safety . . . they are locked in position when assembled. With integral keys for driving, powerful screws for holding, simple compact design, high safety factor, accurate machining, perfect balance, roller bearings, and complete lubrication—Mechanics Universal Joints are rugged, dependable, economical; used in leading passenger cars, trucks, and busses. Investigate.

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New Kent's Handbook

Kent's Mechanical Engineers' Handbook, eleventh edition. Robert T. Kent, editor-in-chief. Volume on Power. Published by John Wiley & Sons, Inc., New York, N. Y.

IN bringing out an eleventh edition of Kent's Mechanical Engineers' Handbook, the publishers have made a fundamental change in the scope and the form of the work. It now constitutes two volumes of the Wiley Engineering Handbook Series of which there are five volumes so far. Vol. I is known as the Handbook of Engineering Fundamentals and covers such subjects as mathematics, mechanics, electricity and magnetism, light and radiation, chemistry, metallic and non-metallic materials, etc. Vol. II, the book here under review, is the first of the two volumes which constitute the new Kent; it deals with power and its varied appli-

cations, and the plan introduced in connection with the previous edition, of having experts in the different fields write the various sections of the book, has been adhered to, the volume including contributions by 28 writers besides the editor-in-chief. The second volume will deal with design and shop practice.

The former standard format for engineering handbooks has also been departed from, the new book having a trimmed page measuring 5½ by 8⅝ in. This is of advantage in that it permits of the use of large illustrations where such are called for, but the chief advantage would seem to be that it keeps down the thickness of the book and renders it handier and more resistant to wear and tear. The new book has 1254 pages, and if the old format had been retained the same amount of material would have covered considerably over 2000 pages, which would have rendered it unwieldy.

There are seventeen sections in the Power volume, dealing with the following subjects: Air, Water, Heat, Combustion and Fuels, Steam, The Steam Boiler, The Steam Engine, The Steam Turbine, Condensing and Cooling Equipment, Refrigeration and Ice Making, Heating Ventilating and Air Conditioning, Internal-Combustion Engines, Gas Producers, Transportation, Electric Power, Power Test Codes, and Mathematical Tables. The Section on Transportation consists of three individual contributions, one on Railroad Engineering by G. E. Rhoads, one on Automotive Vehicles by Ralph A. Richardson, and one on Aeronautics, by Edward P. Warner and S. Paul Johnston. Mr. Richardson, who is a member of the staff of General Motors Research Department, has condensed a large amount of useful data on engine details, engine design, automobile fuels and combustion, the fuel system, the electrical system, the chassis, road tests and engine tests in his section, which covers 44 pages and is illustrated with 84 drawings and diagrams. The data on engine tests are especially comprehensive and include a four-page table of correction factors for pressure, temperature and humidity for application to indicated horsepowers.

Other contributions that are likely to be of interest to automotive engineers include that on Aerodynamics by Edward P. Warner and S. Paul Johnston, that on Diesel Engines by Edgar J. Kates and that on Gas Engines by H. A. Gehres. The two engine articles, however, deal with stationary-engine practice in the main.

The new edition follows the tenth after an interval of thirteen years and is an entirely new book.

Standards on Petroleum Products

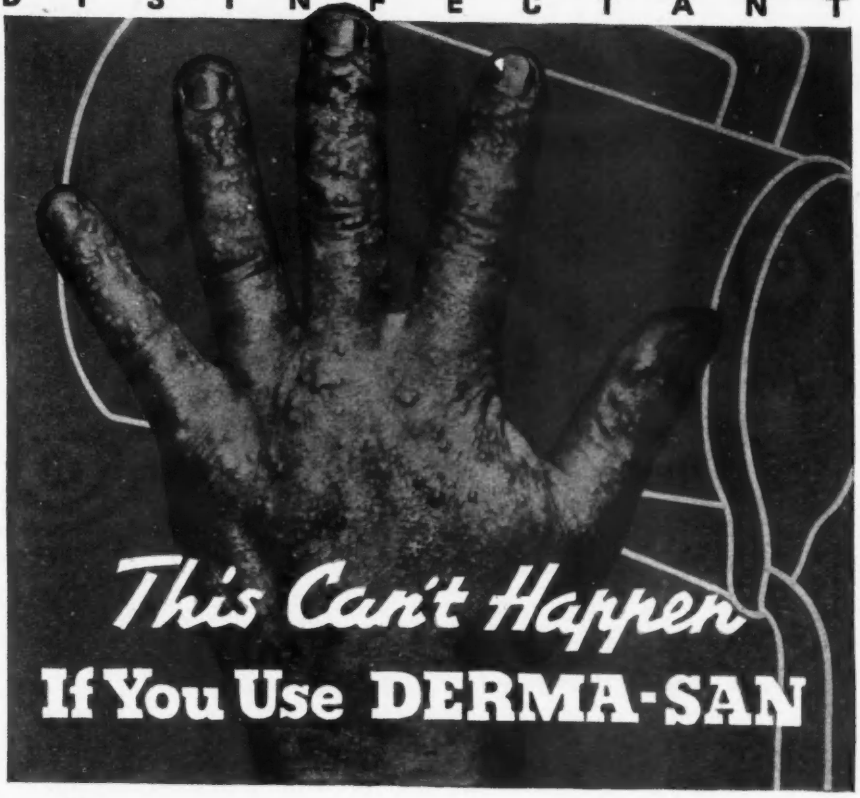
A.S.T.M. Standard on Petroleum Products and Lubricants, 1936 Edition. Published by American Society for Testing Materials, 260 So. Broad Street, Philadelphia, Pa.

THE current (1936) edition of this compilation gives in their latest approved form 56 methods of test, five specifications and two lists of definitions of terms relating to petroleum and to road materials. Committee D-2, which sponsors these standards and methods, in its 1936 report discusses the research and standardization work, details the changes made in the standards, and also gives four proposed methods which have been approved for publication as information and for comment. They cover the determination of kinematic viscosity with the suspended level viscosimeter and by the modified Ostwald viscosimeter, converting kinematic viscosity to Saybolt, and a test method for neutralization number (potentiometer method).

The D-2 report also gives suggested uniform automotive engine lubrication recommendations.

DERMA-SAN

DISINFECTANT



OIL DERMATITIS costs plant owners millions of dollars each year. A single germ of this serious skin disease—carried from worker to worker by infected cutting lubricants—can put your entire force under doctor's care . . . cripple production . . . cause compensation payments. Protect your men from oil infections by using Derma-San. Pour one pint of Derma-San into 35 gallons of cutting lubricant and keep Oil Dermatitis out of your plant.

Derma-San is ideal for all general plant sanitation

The HUNTINGTON LABORATORIES Inc.

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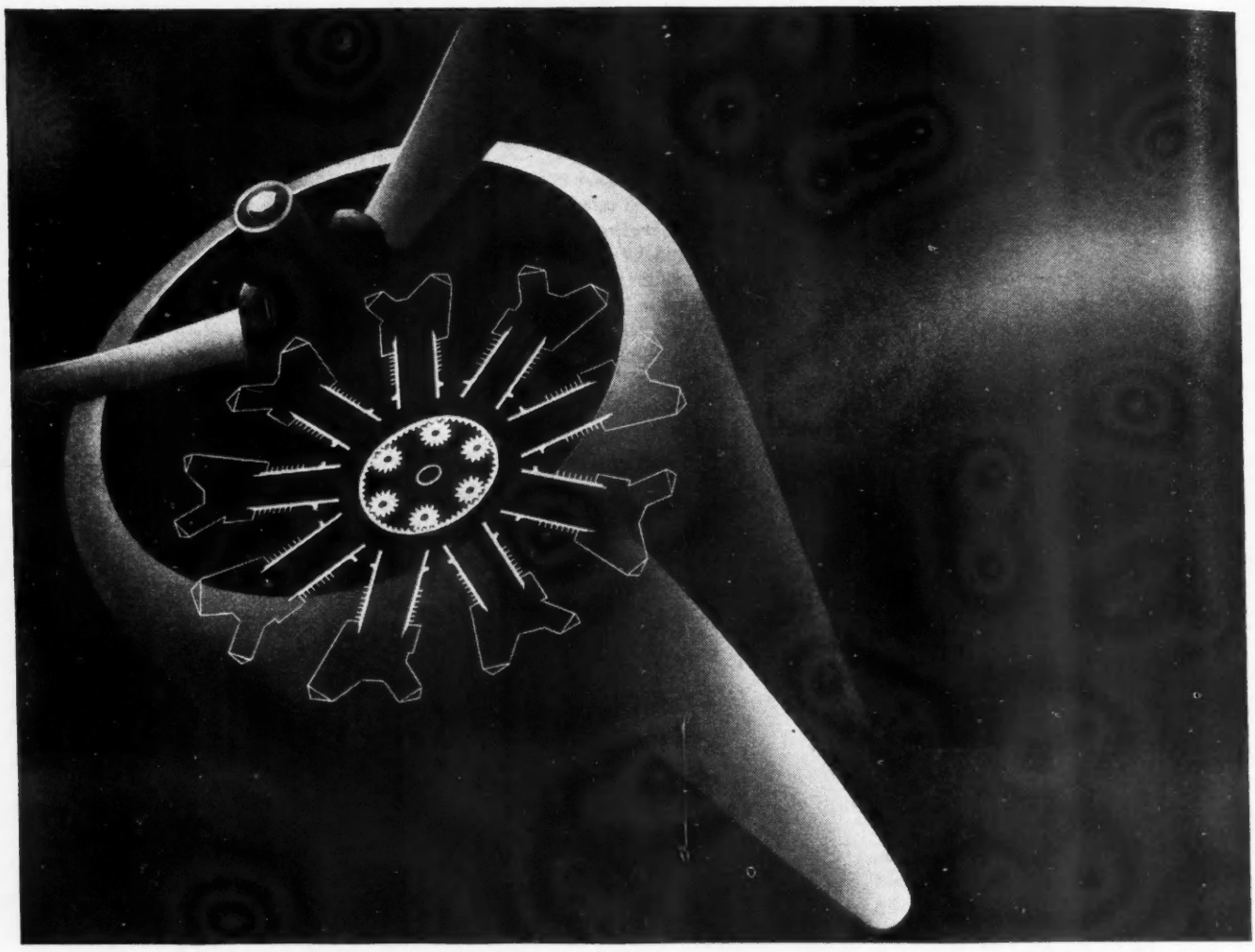

Where DEPENDABILITY is vital

It is still necessary to stress the importance of dependability in airplane engines—directly as a performance requirement; indirectly as a factor in selecting the materials from which they are made.

Dependability is the primary reason why Molybdenum nitriding steels are used for such vital engine parts as cylinders, ring gears and drive gears. For example: They depth-harden uniformly in varying sections. They can be nitrided at the most effective temperature for producing a hard, wear-resisting case; show minimum distortion after heat treating; retain their properties at elevated temperatures.

The same properties which make Molybdenum nitriding steels so effective for their purposes, are characteristic of all Molybdenum steels. No matter what your special problem may be, it will pay you to investigate "Moly" steels. For more detailed information, write for our technical publications, "Molybdenum" and "Aircraft Steels." Ask also to be put on the mailing list of our monthly news-sheet, "The Moly Matrix." For a study of any specific or difficult steel requirement, the facilities of our experimental laboratory are at your command. Climax Molybdenum Company, 500 Fifth Ave., New York.

PRODUCERS OF FERRO-MOLYBDENUM, CALCIUM MOLYBDATE AND MOLYBDENUM TRIOXIDE

Climax Mo-lyb-den-um Company

MOLY